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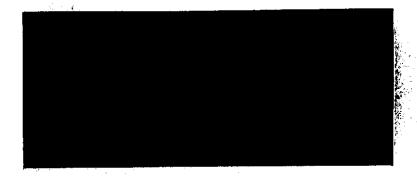
RESEARCH DIVISION

8100 SOUTH 34TH AVENUE, MINNEAPOLIS, MINNESOTA 55440/612-853-8100

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PERIODIC VARIATIONS IN STRATOSPHERIC MERIDIONAL WIND FROM 20-65 KM, AT 80°N TO 8°S

Ву

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For

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PERIODIC VARIATIONS IN STRATOSPHERIC MERIDIONAL WIND FROM 20-65 KM, AT 80°N to 8°S

ABSTRACT

The variability of stratospheric meridional winds is examined in both space and time. Height-latitude sections for January along 70°E and 90°W show a divergence zone above 50 km near 60°N over the former and an intense convergence zone above 40 km near 50°N over North America. This latter structure, with southward winds in the Arctic and northward winds at midlatitudes over North America, persists from October through April. Tidal winds seem to dominate all other circulation features in summer at all latitudes, and throughout the year at low latitudes. To help understand the observed patterns of variability, long-term periodic features are analyzed. The quasi-biennial oscillation, annual wave, and four-month wave have amplitudes of about 10, 20, and 10 m/sec respectively in the arctic near 45 km. The phase of the annual wave changes by nearly 180° in a narrow zone near 45°N. The semiannual wave has an amplitude of 10 m/sec near 50°N above 50 km with equinoctial phase dates in the region of maximum amplitude. This polar semiannual wave corresponds closely to that previously found in the zonal wind.

I. INTRODUCTION

The status of our understanding of the zonal component of the wind in the stratosphere and lower mesosphere is well illustrated by the recent exchange in the literature concerning the exact latitude of the tropical center of the semiannual oscillation (van Loon, et al, 1973; Reed, 1973; Belmont and Dartt, 1973). By contrast, it seems that the only attempt so far to decompose harmonically the meridional wind in this region of the atmosphere has been by Justus and Woodrum (1973), using only three rocket stations. Although several observational models of the zonal wind have been presented in recent works (Groves, 1971; Belmont, et al, 1974), Groves (1969 and 1970) appears to have been the last to model the meridional wind from observations. The object of this report paper is to prepare an up-to-date observational model of the meridional wind, 20-90 km, and to analyze the long-term (greater than one month) periodic features of the meridional wind.* Shorter period features, such as tides, will be referred to often, but an analysis of their characteristics is beyond the scope of this study.

II. DATA, 20-70 KM

Rawinsonde observations provide a dense and continuous data base up to about 20 or 25 km. At 30 km some rawinsonde observations are still available but their reliability and number deteriorate such that they are little better than rocket observations, on a station-by-station basis. Rawinsonde observations for 1200 GMT for the stations listed in Table 1 were extracted from serial climatological publications of the U. S. and Canadian Meteorological Services in the form of monthly means; an indicator of the

^{*} Unless specifically stated otherwise, the word "wind" will be used to identify the meridional component throughout this report.

number of observations used to compute each mean was also available. In the region 30-70 km the results of the Meteorological Rocket Network (MRN) were used. Multiple rocket ascents in a single day were averaged and weighted as one day. The data had previously been consolidated into semimonthly periods (for other purposes), thus individual observations were not used in this study, except as noted. The source of all rocket data was the National Climatic Center, Asheville. The MRN stations used for periodic analysis and the period of record of each are included in Table 8, and the monthly mean profiles at 2 km intervals, 20-70 km, are in Appendix A. Those additional stations which were used for other analyses but which had insufficient data for periodic analysis are listed in Table 2.

Above about 60 km the number of MRN soundings falls off very rapidly, and special techniques must be used to probe the region above 70 km. Thus, due to the large differences in data availability and measurement techniques, the analysis has been divided into two regions: 20-70 km and 70-90 km. Results for 20-70 km will be discussed first.

III. INFLUENCE OF SMALL-SCALE VARIABILITY

A. TIME (TIDES)

Both the zonal and meridional components of the wind are affected by small-scale variability in time and space. Since the amplitude of large-scale features in the zonal wind is large compared to that of small-scale ones, the influence of small-scale features is generally disregarded in studies of the zonal wind. The influence of small-scale features cannot be overlooked when examining the meridional wind, however, since they are often

of the same order of magnitude as the large-scale features; sometimes the small-scale features are dominant.

As noted, the diurnal tide is one small-scale feature that must be taken into account. Details of present tidal theory (Chapman and Lindzen, 1970) are too uncertain to use for correcting basic data for the effect of tides. However, observational evidence of the character of the tide at MRN heights is available for the summertime (Reed, et al, 1969), and for all seasons at balloon heights (Wallace and Hartranft, 1969; Belmont and Dartt, 1970).

Most observations at MRN stations are taken at a fixed local time each day. Thus, one must anticipate that the monthly or seasonal means are aliased by the diurnal tide. Listed below are seven MRN stations, the local time when most observations are taken, and the percentage of observations taken in the three hour period centered at that time; 1964-71.

	Local Time	Percent
Cape Kennedy	10	76
Fort Greely	1,1	72
Antigua	11	74
Ascension	15	88
Point Mugu	10	52
Barking Sands	11	91
Thule	11	73

Figures 1 and 2 are mean summer (June, July, August) vertical profiles at Cape Kennedy and Fort Greely. For comparison, the estimated tidal winds at

various hours throughout the day, computed using the amplitudes and phases given by Reed, et al, (1969) are also plotted. The similarity of the observed mean profile to the tidal wind profile at the most frequent observation hour is significant when one considers that the observed means also contain some data from other hours of the day. This strongly suggests that the computed summertime means are merely a reflection of the magnitude of the tidal wind at the time of day that the observations are taken and that if the data were evenly distributed through all hours of the day the computed mean would be zero. Comparison of profiles at tropical stations shows this similarity for all seasons.

Aliasing of the monthly means by the diurnal tide is probably present in all of the MRN and rawinsonde data due to the fixed hour of observation. At extra-tropical latitudes during seasons other than summer, however, the contribution to the mean from features other than the tide is so large that tidal effects cannot be discerned. The significance of the influence of the diurnal tide on transport computations, and the effect obtained by neglecting this factor, has been studied at balloon heights (Belmont and Dartt, 1970).

B. SPACE (LONGITUDE VARIATIONS)

Longitudinal variations in the mean meridional wind are present at tropospheric heights as the well-known wave number three structure, especially evident in winter (Oort and Rasmusson, 1970). As altitude is increased the pattern transforms into the wave number two structure observed in the mid-

stratosphere (van Loon, et al, 1972). Some of the longitudinal variations in wind in the upper stratosphere and mesosphere can be seen in Figures 3 and 4. Figure 3 presents the observed mean January meridional wind at 50 km in vector form on a polar projection. The vectors are centered at the individual station locations. Flow across the pole and a well-defined convergence zone at mid-latitudes over North America are the most prominent features. The irregular geographic distribution of stations does not permit one to determine how many standing waves are present, although it does appear that there may be a mid-latitude divergence zone near 5°E. These longitudinal variations imply that standing eddies are present in the upper stratosphere. The observing network is not yet dense enough at these levels to resolve wave structure on most scales, but the likely existence of waves must not be ignored when examining stratospheric data.

The presence of a mid-latitude convergence zone over North America is interesting and is consistent with estimates of divergence in the zonal wind. Differencing the mean January meridional winds at Thule and Wallops Island, and at Primrose Lake and White Sands, yields an estimate of convergence of about 1 m/s/degree of latitude in both cases. From continuity, this could be balanced by a vertical velocity gradient of 0.9 cm/s/km or by zonal wind divergence of 9 m/s/1000 km. The magnitude of both of these options is reasonable; in fact, differencing the mean January zonal winds at Wallops Island and Point Mugu at 50 km yields divergence of about 11 m/s/1000 km. The internal consistency of these values indicates that quasi-permanent circulation patterns are probably present in the upper stratosphere just as they are in the troposphere (the Alcutian low, for example). During January, the north-south

gradient of meridional wind (9 m/s/1000 km) appears larger than the east-west gradient of the meridional wind (2 m/s/1000 km) between Wallops and Mugu. This suggests that the irrotational component of the meridional flow may be longer than the rotational component at these heights. Thus, meridional winds derived from the pressure or thermal fields using the geostrophic approximation may not be representative of the actual meridional winds present.

Figure 4 presents the mean January meridional wind at 90 km in vector form on a polar projection. Stations used are listed in Table 5. At this height it appears there may be convergence at the pole; however, the scanty number of observations at Barrow gives little weight to the mean there. A midlatitude convergence zone can be seen near 90°W and near 70°E. The means at 90 km are much smaller than those at 50 km, otherwise little change in general pattern can be detected between these figures. At this altitude the largest longitudinal variations occur in January (Sprenger, et al, 1971). As pointed out by Kochanski (1963), features of the circulation in this region are very complex and a variety of models could be fitted equally well to the same data.

Height-latitude sections of the mean January winds are presented in Figures 5 and 6 for stations near 70°E and 90°W respectively. Note the mid-latitude convergence zone in Figure 6 as opposed to the mid-latitude divergence zone in Figure 5. The mid-latitude zero wind line is nearly vertical in both figures and both have maxima near 50 km in the Arctic and above 60 km near 40°N.

As MRN data along all meridians are collected at very nearly the same local time, the observed longitudinal variations are most certainly real, large-scale phenomena and not caused by sampling the progressing diurnal tide at different locations along its waveform. The persistence of these so-called

standing eddies can be described by the standard deviations of the monthly means. The standard deviations at 30, 40, and 50 km for January and July at Fort Greely, Churchill, Wallops, and Cape Kennedy are listed in Table 3 along with the number of monthly means used to compute each. Note that the standard deviations at Churchill and Fort Greely have inverse trends with altitude during January. The Fort Greely values increase with increased altitude while the Churchill values decline above 40 km. Interpretation of this behavior in terms of the circulation of the stratosphere must await better data coverage than we have now.

IV. MONTHLY MEANS AND STATISTICS, 20-70 KM

A. PREPARATION OF 90°W VALUES

In order to reduce longitudinal variations only stations within 30° of 90° W were used when preparing the height-latitude and time-latitude sections discussed below. A height-latitude section for each month was prepared using the MRN monthly means, 12 GMT rawinsonde data, and grenade data (see Table 5). Each monthly mean value was weighted during analysis by the number of observations used to compute the mean. The same data were used to prepare time-latitude sections at 20, 30, ..., 60 km. Figures 6-9 present the height-latitude sections for January, April July, and October respectively and Figure 10 shows the time-latitude section for 40 km.

Values of the monthly mean meridional winds were read off the analyzed height-latitude sections at 5° latitude intervals for 20, 30, . ., 60 km. In order to gain the benefit of interpolation in both time and

space, these 5° latitude values were compared with the analyzed time-latitude sections and any significant differences were resolved. The resulting values, representative of the middle of the month, are tabulated in Appendix B.

B. YEARLY MARCH OF THE MERIDIONAL WIND

Examination of the height-latitude sections (Figure 6-9) discloses a number of features during autumn through spring. In October (Figure 9) a region of southward winds extends from the arctic to 55°N, while northward winds are organized as a broad belt from 0° - 55°N, above 40 km. The region of southward winds expands southward and intensifies until January (Figure 6), when these winds have their largest magnitude (over 30 m/s) of the year, between 40 and 50 km in arctic regions, with a secondary maximum near 60 km at 40°N. The January maxima are directed southward and northward respectively, while the zero wind line is near where the mean westerly jet occurs (Belmont, et al, 1974a). After January the winds begin to decrease, and by April (Figure 7) there is only a small core of southward winds near 30 km in the arctic and a diffuse band of northward winds above 50 km.

As pointed out in connection with Figures 1 and 2, the summertime profiles exhibit characteristics which are very similar to those of the tidal wind. Since most observations are taken in late morning, one may think of Figure 8 as a crude approximation of a cross-section of the magnitude of the tidal winds in July just prior to local noon.

The progression of the northward-southward structure and the apparent impressions of the tides are also present in Figure 10, a time-latitude section of the wind at 40 km. The appearance of the zero wind line north of 40°N has a similar appearance to the spring and fall reversal lines seen on time-latitude sections of the zonal wind at this height (Belmont, et al, 1974a).

C. STANDARD DEVIATIONS

Standard deviations of the daily winds are tabulated by station and month in Appendix C at 2 km intervals, 20-70 km, along with the monthly mean wind and number of observations used. These values were computed using individual observations for the period 1969-1971 (except as noted). The standard deviations are descriptive of transient eddies and can be attributed in part, to gravity waves, diurnal tide, synoptic events, sudden warmings, and errors of observation. When daily values become available for the eleven years of record used in Appendix A, standard deviations will be included there and Appendix C can be eliminated.

Figures 11 and 12 present the spatial patterns of the standard deviations of individual observations in January and July, respectively. In both January and July the maximum standard deviations parallel the locations of maximum wind. However, note that in July at 50 km the mean wind (Figure 8) changes little with latitude but that the standard deviation (Figure 12) steadily decreases as latitude is increased. Little longitudinal variability of the standard deviations could be found with the stations available.

V. PERIODIC ANALYSIS, 20-70KM

The eleven-year time series of semi-monthly means for each station listed in Table 2 was analyzed for periodic variations using a periodic regression technique (see Belmont and Dartt, 1973). Frequencies analyzed were the long-term mean, quasi-biennial oscillation (QBO), and the first six harmonics of the annual wave. Tests with QBO periods ranging from 23 to 32 months showed little difference, so a QBO of 29 months was used in order to be consistant with previous analysis of the zonal wind (Belmont, et al, 1974). Only the results for the mean, QBO, and first three harmonics of the annual wave are included here. The second three harmonics of the annual wave had small amplitudes, relatively large error estimates, and rapid or irregular phase variations; making their interpretation tenuous if not meaningless. Periodic results are given in Table 8.

The periodic regression technique can be used to analyze a time-series of irregularily spaced data points and can include frequencies that are not integral divisions of the period of record. Also, this technique simultaneously determines a statistical estimate of the errors in amplitude and phase for each frequency included. These error estimates were essential when evaluating the spatial patterns of the amplitude and phase of the component waves.

A. LONGITUDINAL VARIATIONS

Due to unidentified, but possible, presence of standing eddies, longitudinal variations should be expected in the periodic features of the

wind also. Figure 13 shows the height profiles of amplitude and phase of the annual wave at Heiss Island and Thule, and Figure 14 compares the annual waves' parameters at Volgograd and Primrose Lake. Note that the phase dates are nearly reversed between each of these pairs of stations. Thus, the results presented in Figures 15-23 are limited to stations within 30° of 90°W. The dashed-dotted line in Figure 14 denotes uncertainty in the phase profile between 40 and 50 km. This uncertainty is due to the large error estimate associated with a value that does not fit the pattern above or below it. A dashed-dotted line will be used in all following figures to imply uncertainty resulting from large error estimates, conflicting values, or simply a lack of stations.

B. LONG-TERM MEAN (FIGURE 15)

This pattern is basically a reflection of the northward-southward winter pattern at mid and high latitudes (since summer values are nearly zero). A southward core located near 40 km in the arctic and a northward band above 45 km near 45 N are the most prominent features. That the low latitude means are due to aliasing by the tidal wind is suggested by the antisymmetry of the Ascension (8 S) and Sherman (9 N) profiles above 40 km.

C. QUASI-BIENNIAL OSCILLATION (FIGURES 16-17)

This component of the variance has a significant maximum in the arctic near 40 km. However, no appreciable counterpart to the well-known tropical QBO in the zonal wind was found; in fact, the amplitudes below 50 km south

of 40°N are so small that a 1 m/s isoline is included to emphasize the pattern. Despite this, in Figure 16, the maximum amplitude of the QBO near 40 km in the arctic is nearly 10 m/s.

Since the QBO is not tied to a fixed calandar, its time of maximum northward wind is relative. The zero line in Figure 17 is a relative starting time, with the wave moving northward and downward, reaching 60°N at 25 km 24 months after its first appearance at low latitudes. The uncertainty indicated by the dashed-dotted lines in Figure 17 is due to large errors and conflicting values, since when the amplitude is near zero, phase can take on any value.

D. ANNUAL WAVE (FIGURES 18-19)

1. Description

The annual wave is found to be the most significant periodic feature of the meridional wind. It has its maximum amplitude in the arctic near 50 km (Figure 18) with a secondary maximum near 40°N at 50 km. The phase dates (time of maximum northward wind) of the two maxima are antisymmetri about a zone of minimum amplitude near 45°N. The northern wave appears nearly simultaneously over the entire arctic upper stratosphere and propagates rapidly downward. The mid-latitude wave appears simultaneously over nearly the entire mid-latitude upper stratosphere.

2. Aliasing by the Diurnal Tide

A large annual wave would be expected from inspection of the height-latitude diagrams, and is consistant with previous work (Justus and Woodrum, 1973). However, present tidal theory (Chapman and Lindzen,

1970; McKenzie, 1968) and observational studies indicate that the phase of the diurnal tide is constant throughout the year at high latitudes, but that the amplitude undergoes a seasonal variation. Thus, the diurnal variation can alias the data so as to distort the amplitude of the annual wave.

In a preliminary effort to determine the effect of aliasing by the diurnal tide upon the amplitude of the annual wave, several experiments were performed in curve-fitting a three year time series (1965-1967) of individual Fort Greely observations. These three years of observations were all that were immediately available in a non-consolidated form. The distribution of observations throughout the 24 hour period is so biased toward one time that little quantitative significance can be given to the results of these tests. However, the values for the diurnal tide are so similar to those obtained by Reed, et al (1969), (who used summer values, 1959-1966) that these tests probably describe the general effect of the diurnal tide.

Examples of the results of six tests and the frequencies included for each are given in Table 4. M is the long-term mean; A is the annual wave; D is the diurnal wave; and ALL refers to the mean, QBO, and first six harmonics of the annual wave, thus, not including the diurnal wave. A times D is an amplitude modulated diurnal wave with the period of modulation equal to one year.

In Table 4, note that the amplitude of the annual wave at all levels is nearly insensitive to the presence of other frequencies. The phase also

showed little change. The mean, however, especially at 30 and 40 km, changes significantly between examples when the diurnal wave is included and when it is not. The algebraic change of the mean (i.e., more negative when the diurnal wave is included) is consistent with the discussion of Figure 2, since at the primary observation time the diurnal wind component is positive. Thus, the diurnal tide aliases the mean but not the annual wave, so that in the context of this study with respect to the annual wave, the seasonal variation of the amplitude of the diurnal tide is insignificant.

E. SEMIANNUAL WAVE (FIGURES 20-21)

The half-yearly component of the variance has its maximum amplitude above 55 km in the arctic regions. A broad ridge of relatively large values near 55°N extends downward with values in excess of 2.5 m/s everywhere above 25 km. This area of maximum amplitude is analogous to that found in the zonal wind (Belmont and Dartt, 1973); however, no counterpart to the tropical semiannual wave in the zonal wind was found.

The phase of the polar maximum of the semiannual wave is equinoctial, appearing over nearly the entire region of large amplitudes at the same time. It propagates downward and northward reaching highest latitudes two months later. It also propagates southward, reaching the mid and low latitude upper stratosphere about three months later.

F. TERANNUAL WAVE (FIGURES 22-23)

The amplitude of the four month wave has maxima near 45 km at highest latitudes, and above 60 km near 40° N, and has nearly zero amplitude below 50 km south of 40° N. The wave first appears in the region of the polar maximum amplitude and propagates southward reaching a region of minimum amplitudes near 45° N about six weeks later. The phase progression in other regions is often vague due to large error estimates.

This wave apparently arises from the square-wave nature of the yearly cycle of the wind in high latitudes. As seen in Figure 10, the values at a given station latitude are relatively constant in summer and winter, with rapid changes during spring and autumn. Harmonic decomposition of a pure square wave will yield a pronounced third harmonic whose phase follows the phase of the first harmonic by one-sixth the period of the first harmonic. At high latitudes this feature is borne out by the phase dates of the annual and four month waves: 6/2 and 8/2. This reasoning also helps justify the strong rate of change of phase shown in the four-month wave near 45°N, since that is where the annual wave does the same.

G. SUMMARY

The usefulness of periodic analysis as a means of describing the observed wind field is described by the amount of variability removed from the semi-mon thly data. Figure 24 presents the percentage of variability explained by the

mean, QBO, and the first six harmonics of the annual wave. Over 50% is explained in the arctic below 40 km and above 50 km, and south of $40^{\circ}N$ between 40 and 60 km. Percent explained variability is the same as percent explained variance except that the long-term mean is included in the regression matrix so that the mean also accounts for part of the variability.

VI. MERIDIONAL WINDS ANALYZED, 70-90 KM

A. DATA AND LIMITATIONS

The bulk of wind data available in the 70-90 km region were obtained by the acoustic-grenade technique or by ground-based radio reflection or meteor trail drift measurements. Grenade data have the advantage of being derived by a consistent measurement technique at all stations and for the entire period of record (Theon, et al, 1972). On the other hand, grenade data are few in number and when comparing monthly means, one must bear in mind that all or most of the observations for a given month may be from the same year, and that the "observation year" may change from one month to the next.

Data from ground based measurements (meteor trails, partial radio reflections) are relatively plentiful compared with grenade observations. Altitude resolution, however, is a major problem when making these observations (Teptin, 1972; Barnes, 1973). Teptin (1972) has stated that failure to take account of instrumental parameters may lead to misinterpretation of

results. These limitations on the available data must be kept in mind when interpreting the summaries presented below.

B. MEANS

Table 5 lists the grenade and ground-based stations for which data in the 70-90 km regions were available. Grenade measurements are reported in the form of vertical profiles for each ascent. These profiles have been linearly interpolated at 5 km intervals and consolidated by month. The data for Kourou (5°N), Natal (6°S), and Ascension (8°S) have been combined to form an estimate of meridional wind behavior in tropical regions at high altitudes. The resulting mean profiles are presented in Table 6.

Measurements obtained with ground based techniques may be ascribed to a particular level when reported, or they may be merely described as "in the meteor zone." In the latter case the values have been arbitrarily assigned to the 90 km level, since this is near the center of the meteor zone (Teptin, 1972), although in some cases they may be representative of a higher level (Barnes, 1973): Table 7 is a summary of the mean monthly winds obtained by ground based techniques. Ground based measurements are frequent enough to resolve the tidal winds and the prevailing wind, and the grenade experiments were fairly evenly distributed throughout the day (Theon, 1972) so that cancellation of tidal effects should occur. Thus, these means should be relatively free of bias due to tides. Longitudinal variations were discussed in connection with Figure 4. There were too few observations, however, to obtain standard deviations.

Periodic features in the winds measured by ground based techniques have been studied by several groups (Lysenko, et al, 1969; Teptin, 1972; Greenhow and Neufeld, 1961). However, Teptin suggests that results at different stations can be compared only after taking account of the instrumental parameters (Teptin, 1972). The relatively small number of observations by grenade experiments did not permit meaningful periodic analysis of that data.

These summaries have been included in the interest of completeness. As noted above, the uncertainties of the measurements or their scarcity could very well render them meaningless. Until the issues discussed in the literature are resolved and a "normalized" data base is available, use of high altitude wind measurements must be on a provisional basis.

VII. CONCLUSION

Meridional winds in the height region 20-90 km exhibit a large degree of organization. Along 90°W a two-cell structure is present from October through April, with northward winds over 20 m/s in mid-latitudes above 60 km and southward winds over 30 m/s in the Arctic near 45 km. An inverse pattern is found along 70°E during the winter. Summertime profiles are probably different from zero because of aliasing by the diurnal tide. Thorough study of the diurnal tide at all latitudes and in all seasons has not yet been made; however, such a study would be helpful in interpreting the dynamics of the stratosphere and mesosphere.

Periodic components succeed in explaining nearly as much of the observed variability of the semi-monthly meridional wind at high altitudes and high latitudes as they do for the zonal wind. The annual wave is the most prominent feature, with maximum amplitude of 20 m/s in the Arctic near 45 km. It undergoes a 180° phase shift near 45°N. The QBO and terannual wave both have maxima of nearly 10 m/s at the same place as the annual wave.

The semiannual wave has maximum amplitude of nearly 10 m/s above 60 km near 60°N, with equinoctial phase. The semiannual wave in the zonal wind has maximum amplitude in the same place and also has equinoctial phase (Belmont and Dartt, 1973). This implies there is a semiannual northward transport of zonal momentum away from the region where maximum amplitudes of the waves are found. That this must affect the dynamics of the strateosphere and mesosphere is clear; however, this phenomenon and its importance remain to be examined.

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Table 1. RAWINSONDE STATIONS

STATION	LATITUDE	LONGITUDE	PERIOD OF RECORD
EUREKA	80	86	1964-1971
RESOLUTE	75	95	1961-1971
HALL BEACH	69	81	1964-1971
CORAL HARBOR	64	83	1964-1971
CHURCHILL	59	94	1961-1971
TROUT LAKE	54	90	1964-1971
MOOS ONEE	. 51	81	1 <u>9</u> 61 - 1971
SAULT ST. MARIE	46	85	1961-1971
BUFFALO*	43	79	1964~1971
WASHINGTON	39	78	1961-1971
CHARLESTON	33	80	1961-1971
MIAMI	26	80	1964-1971
SWAN ISLAND	18	84	1961-1971
SAN ANDREAS*	13	81	1964-1971
BOGOTA*	5	74	1964-1971

^{* 10} mb data not available or insufficient for these stations.

All data are for 12 GMT.

Table 2. METEOROLOGICAL ROCKET STATIONS

Rocket stations subjected to periodic analysis are listed in Table 8.

STATIONS	<u> LATITUDE</u>	LONGITUDE	YEARS	N(50 km, JAN)
ARENOSILLO	37 N	7 W	1968-1970	12
GREEN RIVER	39 N	110 W	1968-1969	5
SONMIANI	25 N	67 E	1965-1970	5
THUMBA	8 N	77 E	1965-1972	12
UCHINOURA	31 N	131 E	1967	3
WEST GEIRINISH	57 N	7 W	1965-1971	42

Table 3. STANDARD DEVIATIONS OF JANUARY AND JULY MONTHLY MEAN MERIDIONAL WINDS

		30 K	M	40	KM	50 K	M	60 K	M
	STATION	σ	N	σ	N	σ	N	σ	N
January	KENNEDY	2.5	11	2.8	10	6.2	10	10.4	5
	WALLOPS	2.8	6	4.7	6	5.4	6	9.5	2
	CHURCHILL	20.2	7	21.3	7	15.7	7		-
	GREELY	9.8	7	19.0	7	25.4	7		-
July	KENNEDY	.7	11	1,6	11	2.6	11	3.6	6
	WALLOPS	.9 10 1.0 5		1.6	10	3.6	10	1.6	3
•	CHURCHILL			2.7	5	2.2	5		-
	GREELY	0.0	7	.7	7	3.5	7	3.5	5

N given in years; a year was included only if the number of observations was over five.

Table 4. TESTS OF ALIASING OF THE ANNUAL WAVE BY THE DIURNAL WAVE

Fre	quencies		Mean (M/S)		[l Ampl (M/S)	itude	Diurnal Amplitude (M/S)					
	·	30km	40km	50km	30km	40km	50km	30km	40km	50km			
1.	A + D		<u></u>	•	8.3	12.6	14.0	8.7	13,6	7.4			
2.	M + A + D	-8.7	-13.0	-7.5	8.7	13.3	14.6	4.3	6.4	8.8			
3.	M + (A x D)	-4.3	-6.9	-3.6									
4.	$M + A + (A \times D)$	-4.4	-7.1	-4.1	8.2	13.8	14.1			l			
5.	ALL + D	-7.4	-10.5	-4.5	9.0	13.8	15.4	2.8	3.6	6.5			
6.	ALL	-4.7	-7.4	-4.5	8.9	13.6	15.1			ļ			

(See text for explanation of frequencies used)

Table 5. GRENADE, RADIO AND METEOR WIND STATIONS, 40-90 KM

STA	ATION	.LA	т,	LONG	G.	PERIOD OF RECORD	MEASUREMENT TECHNIQUE	REFERENCE	
1,	BARROW	71	N	157	W	1965-1972	Grenade	Theon, 1974	-
2.	CHURCHILL	59	N	94	W	1962-1971	Grenade	Theon, 1974	
3.	WALLOPS	38	N	75	W	1962-1971	Grenade	Theon, 1974	
	(KOUROU	5	N	53	W	1971	Grenade	Theon, 1974	
4.	{ NATAL	6	S	35	W	1966-1968	Grenade	Theon, 1974	
	ASCENSION	8	S	14	W	1964	Grenade	Theon, 1974	
5.	HEISS IS.	80	N	38	E	1965 - 19 67	Radio/Meteor	Lysenko, et al, 1969 Lysenko, 1972	
6.	COLLEGE	65	N	148	W	1970-1971	Radio/Meteor	Roper, 1974	
7.	TOMSK	57	N	85	E	1965-1966	Radio/Meteor	Lysenko, et al, 1969	
8.	KAZAN	56	N	49	E	1964-1965	Radio/Meteor	Zadorina, et al	28
9.	OBN INSK	55	N	37	E	1964-1966	Radio/Meteor	Kashcheyev and Lysenko, 1967 Lysenko, et al, 1969	
10.	KUHLUNGS BORN	54	N	12	E	1964-1966	Radio/Meteor	Sprenger, et al, 1971	
	COLLM	51	N	13	E		R a dio/Meteor	Sprenger, et al, 1971	
11.	SHEFFIELD	54		· 1	W	1964-1965	Radio/Meteor	Muller, 1966	
12.	JODRELL BANK	53	N	2	W	1953-1958	Radio/Meteor	Kochanski, 1963	
13.	SASKATOON	52	N	106	W	1969-1971	Radio/Meteor	Gregory and Rees, 1970 Gregory and Rossiter, 1972	
14.	KIEV	50	N	31	E	1965-1966	Radio/Meteor	Lysenko, et al, 1969	
15.	KHARKOV	50	N	36	E	1964-1966	Radio/Meteor	Kashcheyev and Lysenko, 1967	
16.	GARCHY	47			E	(No data)	Radio/Meteor	Roper, 1974	
17.	DURHAM	43		71		1970	Radio/Meteor	Roper, 1974	
18.	FRUNZE	43		73		1966	Radio/Meteor	Lysenko, et al, 1969	
19.	DUSHANBE	39		69		1965-1966	Radio/Meteor	Lysenko, et al, 1969	
20.	PALO ALTO	37	N	122	W	1967	Radio/Meteor	Barnes, 1972	

Table 6. GRENADE DATA, 40-90 KM

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2 N= 5=	-53 1	82 L	249 1	234 1	-661 !	1			,				2 N* S=	-108 9 359	-84 14 312	-104 14 299	31 15 387	132 15 324	150 15 323	86)5 355		14 499	. 12	114	a 0
3 N= S=	6 3 20	36 3 23	6 3 14	-71 3 38	-67 3 55	-8 3 89	100 3 129	56 3 76	185	3 262	3 712		3 N= S=		64	11	55 l	86	1	1	ı	1	. 1		i
4 N= S=													4 N= S=		-32 i	54 1	1	1	1	-268 1	75	1	٠.	l	.1
5 N= S=	4 2 48	-3 2 30	50 2 44	45 5 86	-74 2 73	-49 2 17	23 2 34	-AA 2 183	} 86	66 66	1 461		5 N= S=	-26 2 58	\$a 5 53	100		51	-17 2 14	47	105	. 5	2 2 5 B4	2	2 8
6 N= 5#	39 7 17	63 3 62	10 3 50	-44 3 60	23 3 62	-7) 1	-31 1 115	-71 3 117	3 316	F F15	313		6 N= 5=	-5A 2 +1	-9 3 77	26 3 136	. 20D	-57 3 71	-1 3 164	168	. 74	198	3 a 2 160	2 6 134	2
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9 N# S=	-58 1 12	-34 13 44	#/9 13 48	1.7	-59 1 45	- 31. 1 1 94	-105 11 113	-144 11 106	13	510	11 673		7a N=	90 1		1	1		i	١	_	1	1	ì	62
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Table 7. RADIO/METEOR MONTHLY MEAN MERIDIONAL WINDS (M/S), 75 - 90 KM

A. 90 KM OR UNSPECIFIED HEIGHT

STATION		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	
5		42	-24 ²	-9 ²	22	-10	-12	-11	-12	7 ²	-8 ²	- 5 ²	. 142	
6		-3				,							-6	
7		-4	4								-8	-13	5	
8		-6	5	4	- 6	-1		- 7	- 5	-6	- 6	2	2	
9		-8 ³	-7 ³	8 ²	-42	-13 ²	-9 ²	-8 ²	-7 ²	-5 ²	-4 ²	o^2	-5 ²	
10		-10 ³	-16 ³	-15 ³	-143	-113	-8 ³	-9 ³	-6 ³	-6 ³	-9 ³	-6 ³	-8 ³	30
11		-9	-4	-2	-14	-22	-14	-16	-9	-2	1	5	-5	O
12 (92k	an)	- 5	3	1	-2	-11	-13	-12	-10	-3	. 2	3	2	
13	·	-1	6	3 ²	25 ²	-6 ²	02		•					
14		- 5							_	-3	3 2 ²	2 5 ²	-7	
15		- 1 ³	3 ³	22	-6 ²	-8 ²	-9 ²	-7 ²	2 ²	3 ²	22	5 ²	-9 ²	•
16				(No dat	:a)									
17				4			٠							
18										-4	-7	-2	6	-
19		4	8							3	- 5	-2	14	
20 (951	km)					-4	-6	- 5	0	-2				· ·

NOTE: Exponents refer to number of monthly means available. No exponent indicates one available.

Table 7. (CONT'D)

		В.	85 KM										
STATION	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	
6	- 3											- 6	
12 (82km)	-8	-1	-2 8 ²	- 5	-14	-17	-15	-13	- 6	0	1	-1	
13	-1	19	8 ²	- 5 ²	-2	-6							
17			-2										
						•							
		с.	80 KM										
STATION	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	
6	- 9											-17	
13	25	2	112	8 ²	-11	-12							
17	٠		-2										
	,	D.	75 KM										
STATION	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	
13		3	202	20	2	1							

Table 8. PERIODIC ANALYSIS RESULTS

	A. <u>51</u>	ATION	+ LIS	T+ NU	мв€н (OF 085	SERVAT	ions.	MEAN	. AND	EARO	9 OF 1	THE HEA	i N										
LEVEL (KH	NARE	: ι	AT (LON	YEARS		MUI 20	MAEN 30	OF 089	SFRVA 50	T LONS	64	20	ME 30	AN I M.	/\$1 50	60	64	E8	90 9091 30	F THE	REAN 50	(#/S	i) 6+
2 3 4 5 6 7 7 8 9 10 6 11 12 13 14 15 16	MEISS THULE GREFLY CHURCH PRIMO VALLOP VALLOP WALLOP WANALI GRITUM GRITUM SHEMALI SHEMALAL SHEMALAL ASCENS	ITLL 15E 18AD 15 10 17 18 18 18 18 18 18 18 18 18 18 18 18 18	77 64 59 55 49 38 32 28 22 21	69 146 94 110 45 87 119 107 76 160 71 67	1/62-1 4/61-1 1/61-1 7/64-1 9/65-1 1/61-1 1/61-1 1/61-1 1/63-1 1/63-1 1/63-1	12/71 0/71 12/71 12/71 1/70 12/71 12/71 12/71 12/71 12/71	603 287 141 852 1654 1790 1401	1795 1557	742 279 136 967 1724 1753 1602 1215 1215 206 596 298	1642 : 1479 1302 167 417	0 79 300 244 143 261 438 1499 313 6 51 278 133	0 25 56 73 0 86 116 673 114 90 0 73 24	0 -3.4 -1.7 .2 .0 1.0 1 0	-9.0-		-7.7 -4.2 -1 2.4 1.4 9.4 7.3 8.3 7.2 5.6 5.4 6.0 5.0	12.) 0.0 7.0 4.1 7.7 6.8 8.1 0.0 7.9		.9 .7 .2 .3 .5 .1 .1 .1 .1 .2 .6 .1	1.6	2.3 1.7 .5 .6 .7 1.5 .1 .1 .1 .1	5.2 1.7 .6 .5 .9 1.7 .4 .2 .2 .8 .4 .4	1.1	0.0 19.2 92.9 38.8 4.4 0.0 2.0 1.9 .6 1.3 1.6 0.0 3.4 0.0 2.1
	H. AM	-			IND PI	145P - 1					s - 0#	THE 4	JMI 124	_	_									
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2 3 4 5 6 7 8 9 10 11	3.1 2.0 2.0 1.8 1.8	1.3	3.6 9.5 1.7 4.0 5.3 .7 .7 .8 1.1	7.4 6.6 7.1 1.5 5.0 7.5 .7 .7 .7 .0 6.6	1.7	0.0 /0.1 19.7 10.1 0.0 1.1 7.9 4.5	1.2	1.6 1.4 .; .6 1.0 .2 .1	2.6 2.2 .1 .6 .7 1.9 .2 .2 .2 .2 .3	5.9 2.1 .6 1.3 1.8 .5 .3 .3 .3	0.0 3.0 1.3 1.3 2.3 0.0 1.1 .4	5.5	36 -21 44 76 27 -46 -136 -107 -64 -26 78 89	126 -71 -104 28 -11 -27 -19 143 -168 74	155 -74 -95 -28 -71 -9 -133 -23 164 -120	-136 -71 -08 1 -90 122 -141 -153 170 -159 -158 -165	0 -136 1 -138 -138 0 -129 -63 68 31 0 98	0 +18 91 +128 0 -115 -117 +20 +137 -95	21 30 12 58 22 99 62 24 11 37 23	80 17 76 14 21 51 12 10 69 32 15	62 11 17 12 72 23 16 8 26 10	93 20 23 27 14 64 10 31 88 21 29 86 40	0 51 50 64 31 68 68 66 100	0 H0 15 66 35 0 101 32 54 13 21
14 15 16	.6	2.2	1.2	.6	3.3	4.3	. ž	.1	3 . 1	.3 .5	1.1	3.5 5.9 2.3	166 135 -113	128	109 45 92	-13) 26	85 37	110 70 152	16 46 13	7 11	17 14 11	66 66	14 36	71 52 77
LEVEL IKM 51ATION ? 3 4 5 6 7 8 9 10 11 12 23) 7 0	8.7 12.J	40 40 12.8 18.3		60 0.0 12.4 14.0	n+ u.0			27H ES UDF EF 40 3.1 2.2 .8 .9 .9 .1 1.4 .3 .2 .2 .2 .2 .3 .4 .3 .4 .3 .4 .4 .4 .4 .4 .4 .4 .4 .4 .4		0.0 1.1 1.2 0.0 1.1 7 .7	0.0 11.4 0.0 11.6 0.0 2.0 2.0 2.0 1.4 1.7	162 -25 -371 153 -46 -166 -105	30 -161 -160 -166 -177 -13 -0 171 -24 100 -139 -116	-167 -170 -179 -1 -31 -31 -9 -17 57 -33	-176 -32 0 13 1 -15 -23 -121	60 -175 -175 -177 138 10 117 -27 20 126	64 0 174 3 - 92 2 0 102 497 - 27 - 59	20 23 14 5 10 71 10 11 10 4 21 26	PHASE 30 15 7 3 4 50 6 6 14 1 4 4 53	ERROR 40 157 3 5 67 16 6 4 7 10 16	50 171 39 99 74 74 74 74 74 74 74 74 74 74 74 74 74	69 0 17 6 8 8 6 11 9 9 3 0 42	64 01 100 H2 64 64 49 66 36 0
15 16	1.7	.7	1.2	1.A 2.7	1.1	0.0 5.1	.1	i	.3	.6	, q 1 . n	0.0	115	-161 63	-122 133 176	145 132 -168	+130 +2 -100	0 -48	16 9	26 9	34 13 7	38 19 6	20 69 53	33 0 38
	D. 4M				Ю РНА	SE (0)	EGREES	i) . ¥1	TH ER	RORS.	OF T	HE <u>SE</u>	M] ANNU	AL WA	YE									
LEVEL (KM)	20	30	PL 17U	D€ 50	60	64	0 S	90 30	40 40	#0# 50	60	64	20	30 P	324H 40	50	60	64	20	PHASE 30	ERPOR	50	60	64
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16	5.4 3.1 1.3 2.0 1.8 1.9 .5 .2 .1 .5 .1 .4 2.0 .5	7.4 2.0 4.7 2.6 1.5 1.1 .3 1.0 .3 1.4 .2 1.3		2.1 2.8 7.4 3.2 4.3 1.4 2.6 4.8 2.1 1.6	0.0 10.7 3.3 5.6 6.0 2.2 1.1 1.1 2.5 1.4 0.0 3.7 1.3	9.6	1.2	2.2 1.0 .4 .7 .7 .9 .2 .1 .1 .3 .1	2.9 1.6 .7 .9 1.0 1.5 .2 .2 .2 .2 .1	4.9 1.6 .8 .7 1.3 2.0 .6 .3 .4 .4 .5 .3	1.4	0.0 6.2 56.1 78.6 0.0 2.3 2.3 2.3 1.7 0.0 4.4 0.0 2.6	-96 -95 87	-155 178 -14 -12 -105 -61 -18 -177 -94 -99 -23	-139 -163 157 -71 -2 12 -23 101 -13 -44	-129 176 179 -109 -3 16 -18 -67 -25	-147 -178 173 0 28 62 -38 125 16 -6 -120 -78	-151 -162 -162 -18 -35 -762 -110 -77 -77 -77	12 18 11 12 12 20 20 31 81 85 31 23 43	18 93 13 9 14 52 11 27 13 14 48 13 11	29 75 15 9 11 64 5 7 15 7	95 73 24 14 9 53 8 10 8 9 11 12 16 22 37	0 18 29 17 22 0 34 42 27 19 50 66 63 31	07 97 83 79 65 28 17 21 37 0

.

Table 8. PERIODIC ANALYSIS RESULTS (CONT'D)

	F. AP	PLIT	UDE IH	(5) AM	49 N	ASE ID	EGHFFF	O - 41	14 F	2#QR5	OF.	THE <u>F</u> 1	DUR MOI	<u> </u>	AVF							•		
		A	MPL 17	JOE			AM	PL TTL	DE EF	AOB.					PHASE					PHASE	FREN	a		
LEVEL (KM) STATION	20	30	40	50	90	64	20	30	• 6	50	60	64	50			50	60	64	50	30	40	50	60	64
1	3,7		12.7	6.9	0,0	0.0	1.1	2.1	3.0	5.4	0.0	0.0	-163	164	-165	-72	0	0	19	17	14	64	٥	σ
2	2.3	1.6	7.4	5.3	7.1	4.2	.9	1.4	2.2	2.1	3.0	7.5	-24	- 13	17	2.5	130	-88	25	24	17	25	29	83
3	.3	• 1	.9	3.3	2.9	14.3	. 2	. 3	6	. A	1.4	56.0	85	-70	-3	7	-22	120	58	95	59	14	34	97
4	.9	.8	1.7	2.3	2.4	15.2	. 4	.6	. 6	.7	1.4	74.6	-61	142	119	99	150	1.6	30	61	33	17	45	70
5	1.1	1.2	3.8	4.4	6.7	4.7	. 4	. 10	1.0	1.2	2.1		-56	133		-170			21	35	15	17	32	68
6	1.6	2.8	2.9	1.9	0.0	0.0	. 6	1.1	1.7	1.8	0.0	0.0	20	31	-6	142			26	26	49	73	36	0
7	. 6	. 2	. 9		2.3		. 2			1.4	1.0	2.6	-175	+76	13	75	5ž	-28	14	74	21	78	31	26
8	. 1	.2	.2		1.8		.1	-ĩ	-1	.3	. 7	1.8	-69	177	18	14	85		62	23	4.7	37	24	
ō	. 6	.6	. 9	. 9	7		• ;			.3				-124	41	32	•9	98	95					80
10	. 7	.4		1.9	3.1	3.9				.3									ž	10	12	25	47	92
iĭ	. 3	.4	.;	1.5	3.0	1.	-:	• •		• • • •	9	1.7		-112	-25		-111		. 5	22	9	10	15	29
iż	.5	.;	.5				• 1	٠.	• 1	• •	7	1.4	-72		Ð		-133	-100	15	1.1	58	11	74	75
				1.7	0.0		•5	. 3	- 3	. 9	0.0	0.0	-300	106	93	-36	D	0	23	26	74	39	0	9
13	2.1	• 2	. • •	. • 9	2.4	0.0	.6	• 1	•2	.5	2.0	0.0	яз	-4 T	-139	-46	46	D	22	53	44	4 L	67	0
14	.9	.5	1.5	1.0	1.6	7.8	.2	.3	. 2	. 4	. 9	4.2	155	-43	34	126	-10A	-34	9	36	9	29	34	39
15	2.3	-2	• 1	. 6	4.3	0.0	.5	- 1	- 2		1.2	0.0	i	-145	-10	-+2	-108	O	12	47	8.3	77	17	O
16	.2	. 3	. 3	. 3	1.2	ė . 1	- 1	- 1	- 1	. 2	. 0	2.5	-17	17	-06	-121	0.0	-61	24	27	36	41	4.4	6.0

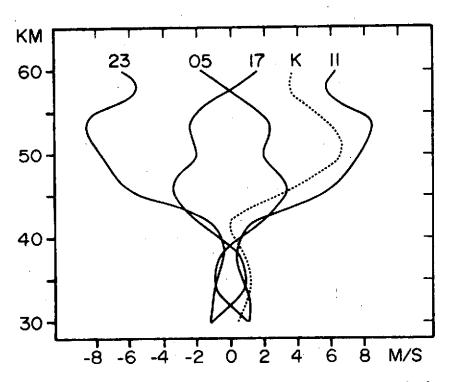


Figure 1. Mean summer (June, July, August) meridional wind observed at Cape Kennedy (dotted) compared to estimated tidal winds computed from amplitudes and phases given by Reed, et al, (1969).

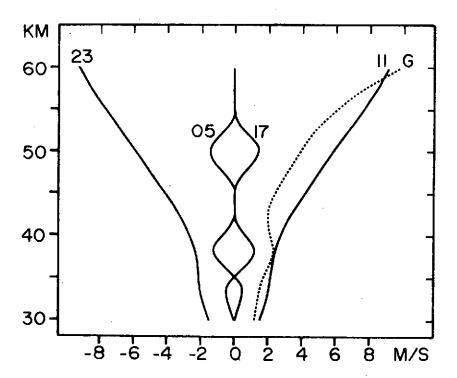


Figure 2. Same as Figure 1 for Fort Greeley.

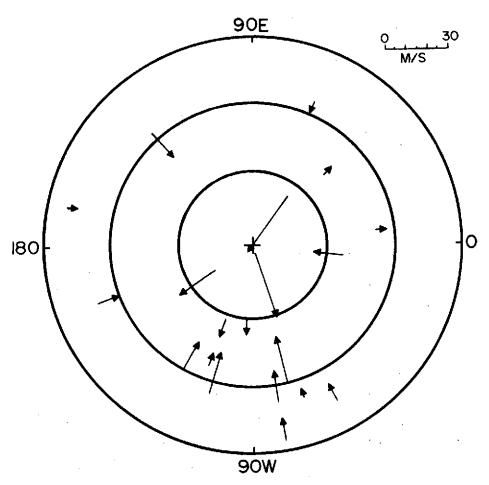


Figure 3. Observed mean January meridional winds at 50 km. Vectors are centered on stations.

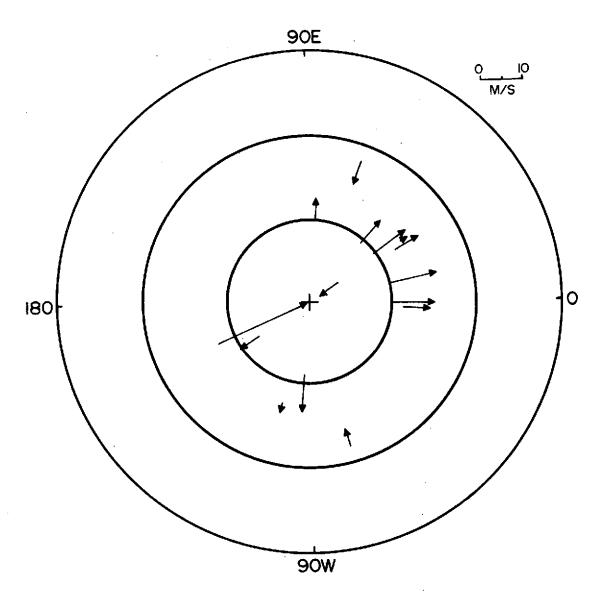


Figure 4. Same as Figure 3 for 90 km.

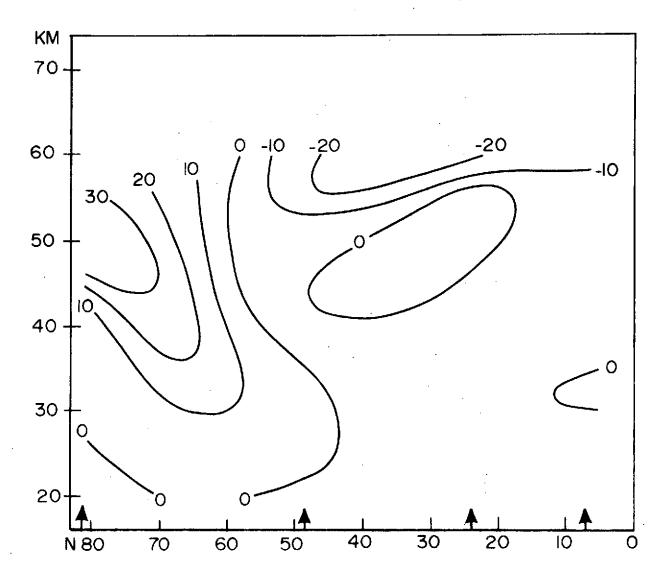


Figure 5. Mean height-latitude section of meridional wind near 70°E in January.

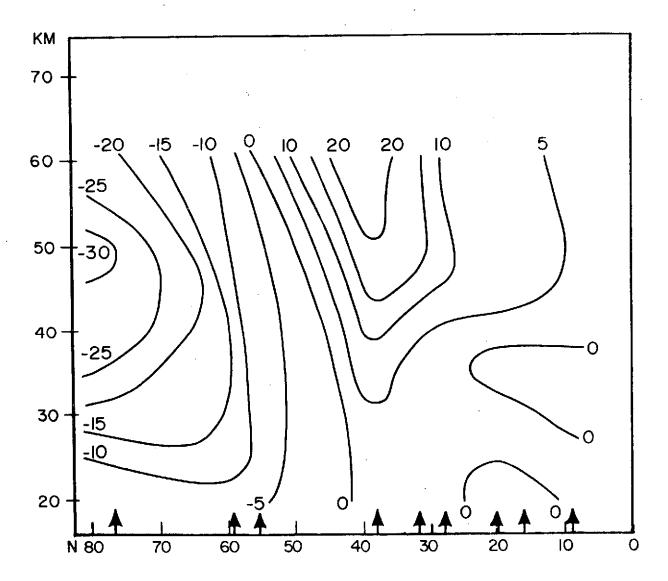


Figure 6. Same as Figure 5, near 90°W, January.

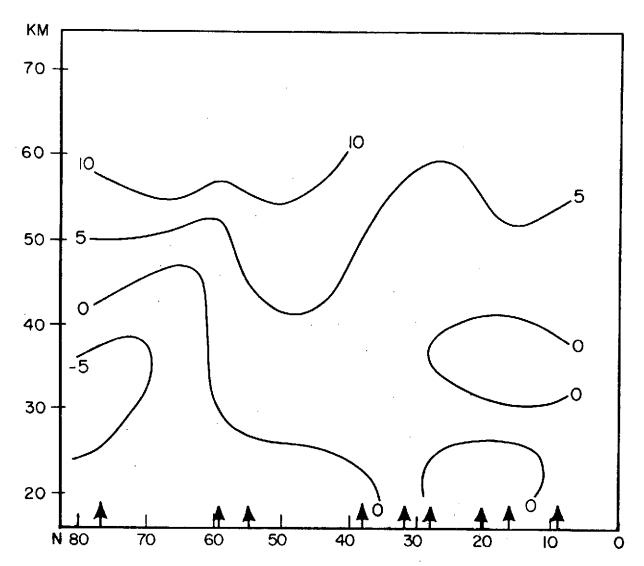


Figure 7. Same as Figure 5, near 90°W, April.

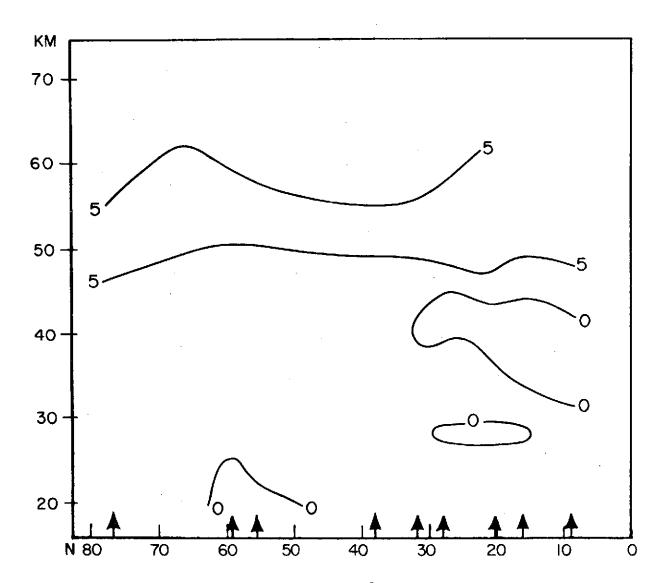


Figure 8. Same as Figure 5, near 90°W, July.

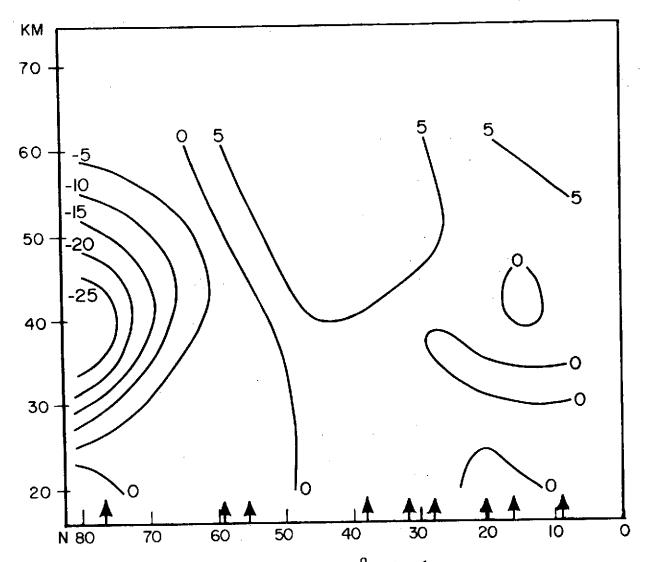


Figure 9. Same as Figure 5, near 90°W, October.

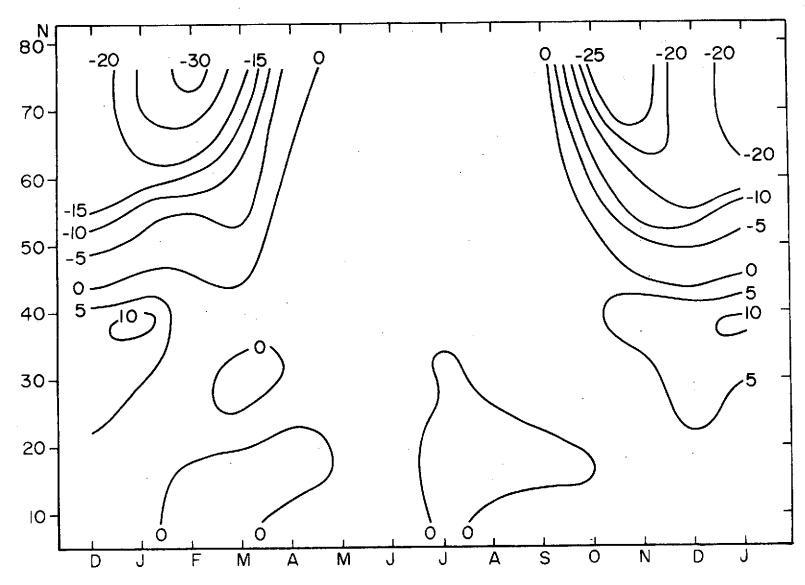


Figure 10. Mean latitude-time section of meridional wind at 40 km.

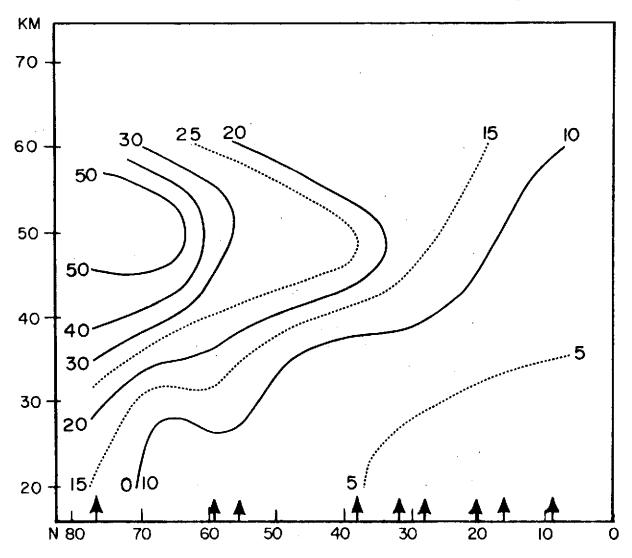


Figure 11. Standard deviation of daily observations in January, 1969-71.

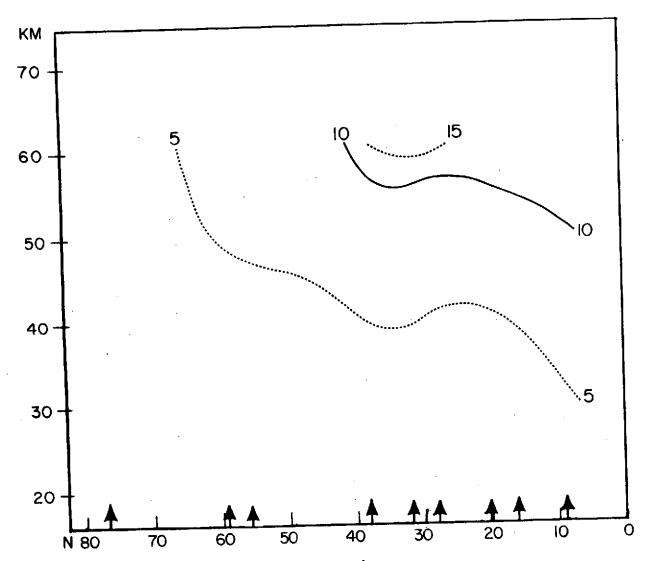


Figure 12. Same as Figure 11 for July.

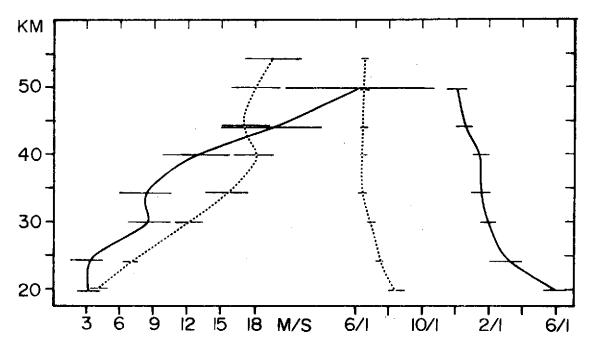


Figure 13. Amplitude and phase of annual wave at Heiss Island and Thule

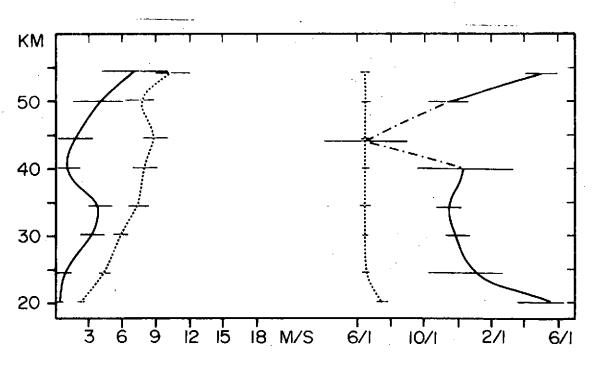


Figure 14. Same as Figure 13 for Volgagrad and Primrose Lake.

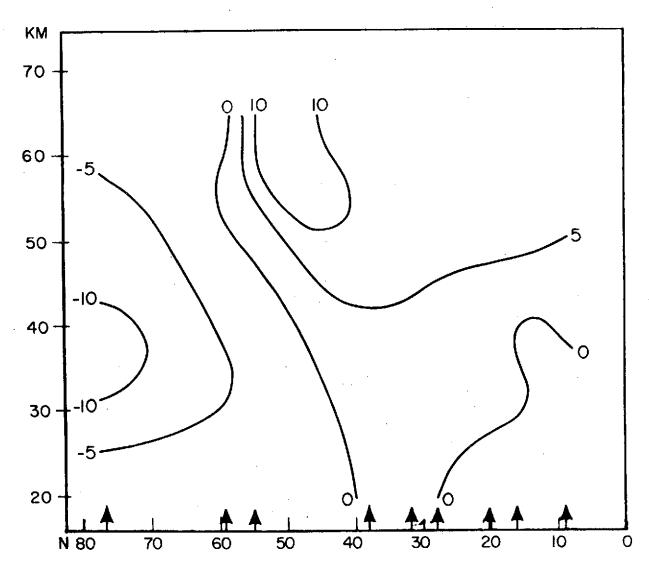


Figure 15. Amplitude of eleven-year mean meridional wind.

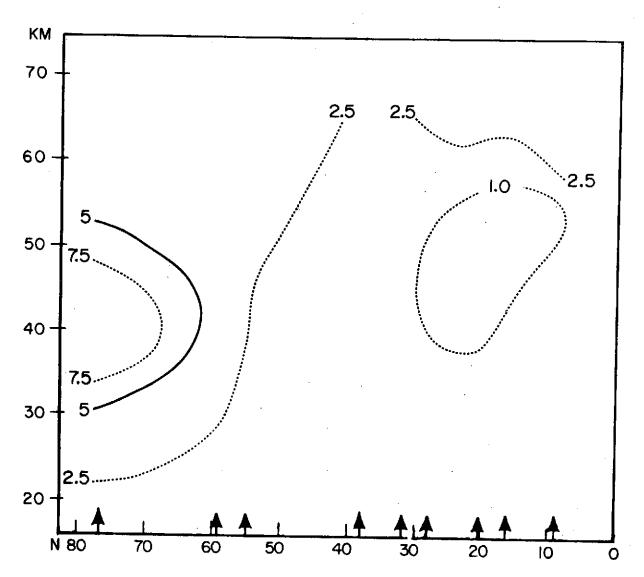


Figure 16. Amplitude of quasi-biennial period in meridional wind.

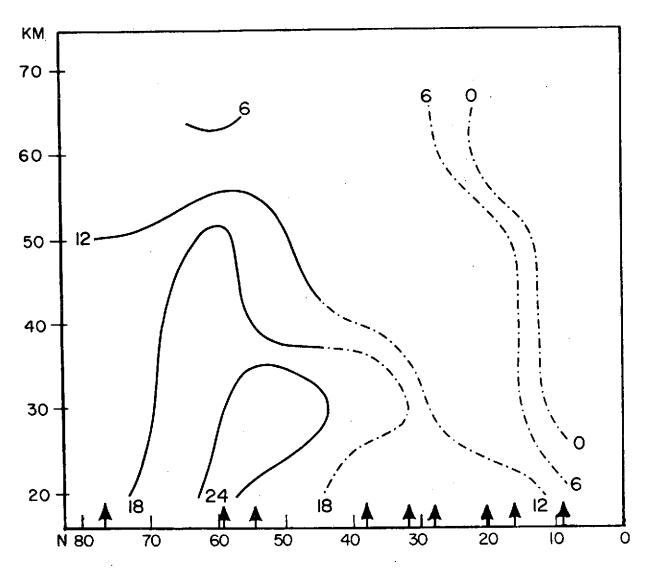


Figure 17. Phase of quasi-biennial period in meridional wind.

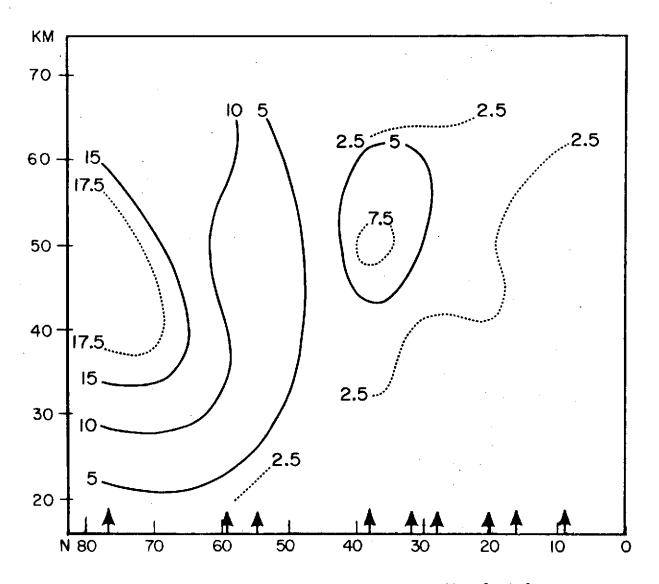


Figure 18. Amplitude of annual period in meridional wind.

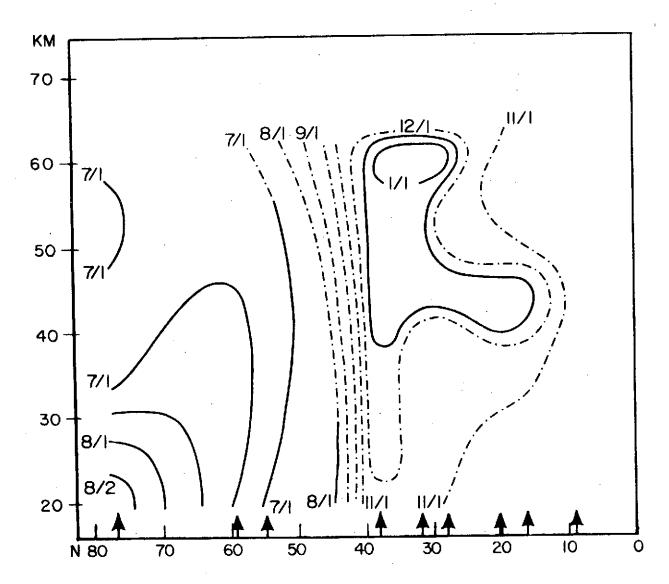


Figure 19. Phase of annual period in meridional wind. Only monthly intervals from 8/1 to 12/1.

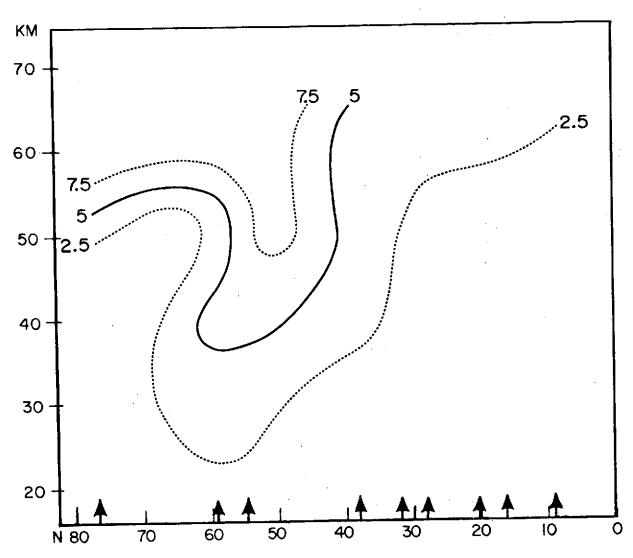


Figure 20. Amplitude of semiannual period in meridional wind.

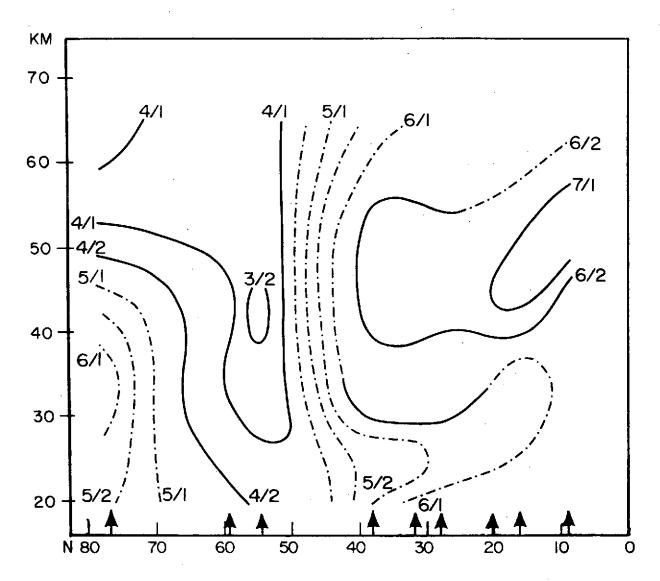


Figure 21. Phase of semiannual period in meridional wind.

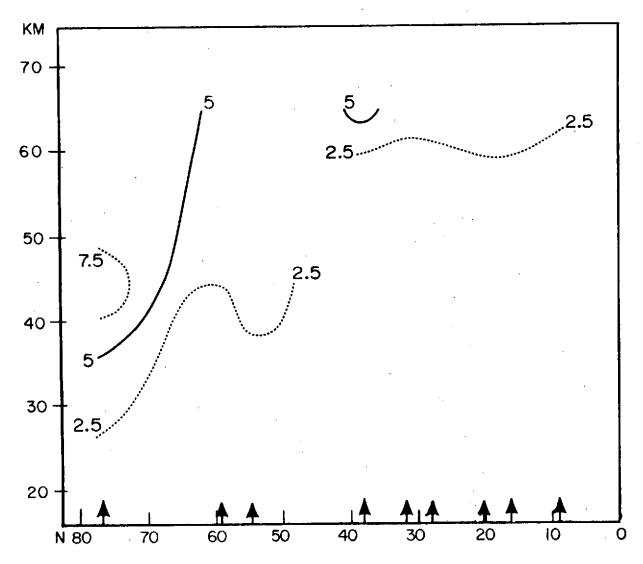


Figure 22. Amplitude of terannual period in meridional wind.

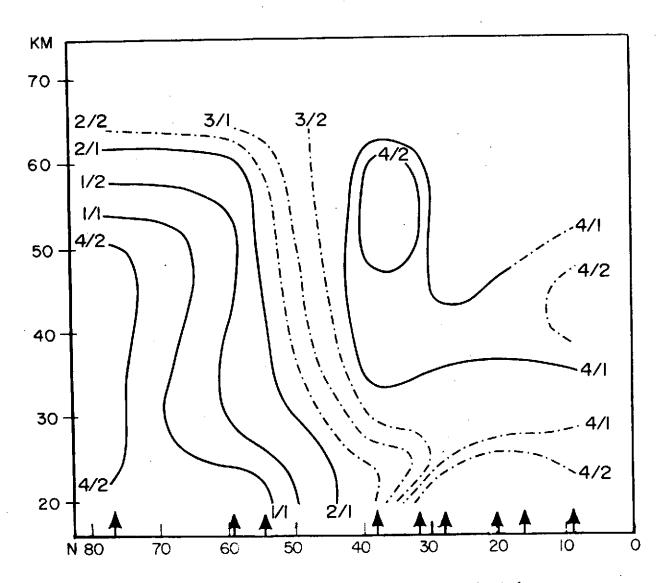


Figure 23. Phase of terannual period in meridional wind.

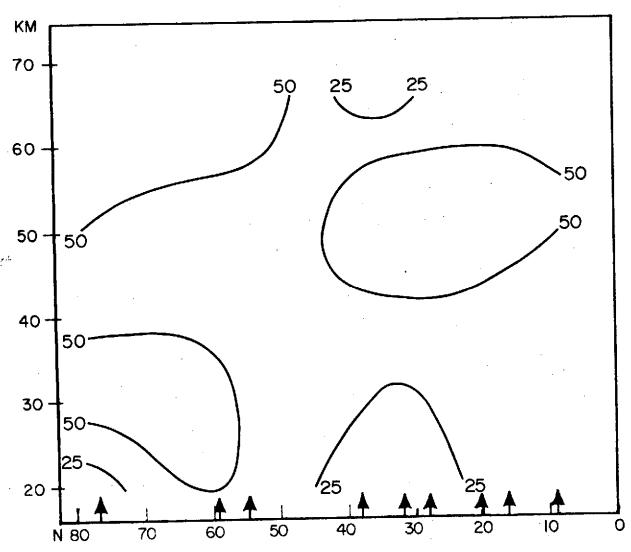


Figure 24. Percent of variability of semi-monthly data explained by eight periodic components.

APPENDIX A: LONG-PERIOD MONTHLY MEAN MERIDIONAL WINDS, 20-70 KM, BY STATION, AT 2 KM INTERVALS.

				_		40	HORIT			FRIDI	ONAL	WIND	AND	*UMBE	OF '	OBSERY	# I LOM	30 21	, 10	, 4 (16)	-	
										LATE			LONG	LTUDE	-59	¢ M	/SEC	TEMES	S TEN	ı		
			PERIO	O OF	RECOM	10 L17	סב יי	• • • • • • • • • • • • • • • • • • • •	**							SOKH					60KM	70KM
MON	H/LEV	EL			-	IOKM				•	DKM									-202	-337	
1	-46	-54	-30	10	56	49	45 55	69	66 66	70	39	-10 17	41 12	153	316	309	305 3	.1	-63	-202	2	
N= 2	21	21 180	255	265	322	428	423	512 13	507 13	545 13	582 12	531 11	534 11	537 8	3A0 A	203 3						
N=	13	13	13	13	13	116	13	131	137	170	157	245	225	252	47	60						
3 N=	57 6	39 6	6	7	7	7	7	7	7	ń	6	6			167	66	150	45	-25	180	190	
	-26	-9	-30	-30 18	-46 18	-22 17	-7 17	-5 17	-47 17	17	10 15	-46 11	-154	8	107	5	. 5	S	2	1	1	
N=	17	17	19			-18	-16	- A	-71	. Fa	22	109	25	-49	-112	12	50	15 2	15	5 01	15	
5 N=	-69 18	-04 JR	18	19	19	19	19	19	19	18	18	9	8			-^	45	17	10	-0	10	
6	7	-6	. 4	29 17	14 17	-5 17	1A 17	5 17	12	12 17	17	97	116	24	-6 7	-0	-6	3	3	3	3	
NE	17	17) 7 -2	42	21	-57	-21	38	4		27	64	28 [A	36 1+	-2 13		-50 6	-0 4	113		183	
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A	-5	4	1 10	-24 11	5 11	-60 11	5 11	12	74 11	25 11	1 L	-42 8		393 3	503 3							
N=	10	10			-0	25	-	56	14	11	97	13	47	.89 7		120	67	23 3		-90	130	
N=	25 12	12	12 12	35 12	12	15	15	13	12	11	11					404	580	630	640	630	510	
10	-64	-56	-49	-40	-54	Ą	-) •	74	47	9	4	н	•		•	•	•	•	-	1	ı	
11	-14	- 30	34	31	AH	46	68	164) 16 A	118	321 7	150	561 1	916	397	De	+30	585 2	610	520)50 1	
N	8	A	9	4	9		٠,	-	160			/88	500	620	686	748	633	553	470	500	-440	
) 2 N=		+100 A	- h 4	-) 4 A	-1T 7	~! 7	7	7	. 7	7				•		•	,		•		•	

					DDAFT	F5 8	F MON	THLY I	4E AN	MERIO	[ONAL	w]ND	ОИА	NUMBE	R OF	OBSER	OTTAV	MS+ 21	g ta	70 KM+	FOR	THUL	_			
												77		[TUDE	69	,	M/SEC	TIME	S TEN	1					_	
			P.C. I.	QU 124			-				40KM					SaxM				•	OKM				1	OKM
HON	HILE	VEL				38KH								221	_303	-301	-283	- 351	-244	-236 -	- 325	-330	-300	-260		
	- n t	21	21	71	- 71	- 21		E 11									-283 12							,		
2	-113	-121	-164	-213	-249	-260	-25A	-255 14	-278 14	-233 14	-305 14	-235 •	-274 14	-234 }4	-287 13	-27a	-322 5	-228 5	-145	50 3	25	2	10			
N=	-36	14 -55	-40	-93	-120	-131	-172	-1/2	-192	-200	-227	-197	-244	-225	-216	-198 17	-168 17	-240 13	-164 L3	-107 ·	-155	-150	-40 1			•
N=	19	īφ	19	19	19	50	70	20	20	~ ~	20 -35		74	26	37	43	_	63	77	104	110	135				
4 N=	-29 24	-4.2 25	-41 24	-51 25	-62	-71	-54 24	-61	-51 23	- 34 22	22	55	25	51	51	20	15	1+	A		5	2	-40	90		
•	10	7	12	20	20	- 9	-6 17	-7 17	16	21 16	39 16	17 15	14	2 14	14			10	-27	66	26	-47 3	-40 2	ĭ		
Ne	19	17	17	17	17	17	10	17	,	• • •	14	21	18	24				29 35	30	29 24	25	60	-47 3			
6 N=	49	49	5)	51	41	5Ĭ		51	50	50	49	49	49	41	45				40	45	17		-109	86	75	-91
7	15	15 35	8 37	6 37	10 36	13 36		22 35	17	19 34	17 73		21 31					26	25	19	į	•	5	1	5	5
No	-7	J7	10	14	14	13	. 20		25	20	31		76 38						75 21	73 15	36 8	9	43	55 2	100	
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10	2	31				1	- J.	. 24	-76	- 20	(2						-135 18		9		5	5				
11	26 -35	-70	-125	-173	-220	-245				-296	-295	-2H7	-209 30	-294 39	-290	-21 3 3	3 -272 1 24	-224 L9	-163	-167 13	-151 10	-93 7	-63 3	-85		
N=		36	36	36	. 10				-117	-143	- 46	-122	-114	-9	104	9 -11	3 -214	-231								
12 N=									15	1*	1 4	16	. 1*	, 1	. 13	3 1	3 ,	9 6	. 4	. ,	•	•	•	•		

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														A	2													
				VEAT	ICAL	PROF I	LES 1	F MON	THLY	MEAN												I. FOR	GREE	LY				•
	. .			PER1	00 OF		RD 4	/61 T	0 8/	71		TUDE 40KM	64	LANG	! TUDE		50KH	M/SEC	: TIME	S TEN		60KM					70KM	
		1/LF1 •49 BZ	-57 82	-76 88	-95 82		-131 61		80	80	-191 79	681- 08	18	10		, ,	47	-					-					•
2 N•		-22	-37 96	-48 07	-6A 98	-100 98	-89 98	-114 98	-134 9A	-149 98	-170 96	-175 96	-193 94	-202 91	-205 ⁽	~169 A8	-184 85	-187	-167 72	-172 48	-158 16	~165 19	-70 14	173 5	535	164 2	365 2.	•
3 N=		34	-50 90	-61 99	-66 98	-75 98	-82 98	-47 99	-77 98	-80 98	-74 98	-78 97	-86 97	-72 97	-66 93	-63 90	-61 86	-49 80	-55 65	~31 46	-14 27	-20 13	5 98	134				,
4 No		18 10	10 108	107	107	3 105	-1 104	-9 193	-9 103	-11 100	-16 99	-17 100	-A 84	-17 96	-7 93	٥ŀ	17 89	55 85	52 79	106 62	77 39	151	129	94	110	146	150	
. 5 N=		22 97]4 98) 6 98	15 98	14	15 97	17 96	13 96	70 97	19 97	22 97	20 97	74 95	24 93	32 91	42 91	59 90	62 84	82 75	59 63	72 37	176	95				
6 N=		7 82	14 62	13 82	12	17 A2	15	# 5	14 62	22 82	25 84	22 R3	19 83	16 83	26 83	38 63	57 82	50 81	58 6)	78 77	85 64	111 50	104 24	6	102			
7 N=		10 92	я 92	1 D	10	1 i 92	14	12	13	20 92	28 93) 7 93	24 93	20 91	17	38 89	56 88	63 87	95 82	63 76	83 69	100 50	78 24	114	260 1	-80 2	39	
8		79 74	74	74	Я 74	6 74	3 74	12 74	1A 74	15 74	1A 75	12 74	14 74	19 72	30 72	31 70	33 69	37 68		65 63	70 57	76 41	64 19	103 7	55	54 3	2 -55	
9		21 78	19 78	14	9 78	6 78	4 78	2 78	6 78	6 77	13 75	3 75	11 72			55 66	58 66	70 65		77 49	.71 45	65 29	167 10	330 1	320 1			
10 N=		36 93	38 93	23	19 93	7 92	-15 91	-25 91	-32 91	-43 90		-74 86	-76 84					-69 65		-1+ 48	-38 30	-1 11	-2					
11 N=		-16 82	-10	-28		-54 A2	-65 82		-98 19	-100 78	-118 77	-123 74	-145 72	-166 71	-166 69	-205 67	-162 62	-161 58	-154 49	-137 41	-119 27	-199 B	-380 4	-112 1	-120 1			
	:	-14 62		-	-44	-70		-134	-157	-180	-203	-237 64	-249	-241	-187	-156	-150 53	-171 51	-177 45	-183 30	-94 19	-43 12	-20	70				

			VERT	1CAL	PŘQF 1	LES 1	F #ON	1 HL Y	ME AN	MERIO	[OHAL	#1N0	AND I	NUMBE	P OF	09569	ng t av	NS + 20	TO	70 KM	· FOR	CHUR	CHILL	•		
			PERI	ON OF	RECO	RD 1	/61 T	0 12/	3 1	LATI	TUDE	59	LONG	ITUDE	94	**	M/SEC	TIMES	TEN							•
MON	TH/LE					30≮∺					4 Q K JH					50K#					60KM					70KM
1 N=	-70 64	-105	-116	-134 Al	-152 62	-167 82	-177 #2	-180 81	-179 81	-176 81	-169 81	-149 80	-126 80	-9u 78	-93 17	-05 75	46- 86	-32 57	-+1 35			-239 14	-438 5	1	,	
5	-96	-85	-93						-129	+115		-95		-62		-23 62		-30 47	-73 36	-124 26	-157 17	-354 13	-549 8	-560 2	-657 1	
N=	60	60	69	70	70	68	67 -)5	67 -60	65 -57	-63	46 -55	-46	65 -43	63 -45	-34	-22	-6	-17	-9	56	-2		-147	_		
N=	-23 64	-3? 64	-34 71	-30 70	-36 72	-+3 72	71	71	71	70	70	70	49	67	67	65	56	4.3	30	22	16	8	3			
4 N=	-24 0	~57 40	-11 47	-2 47	-12	46	7 46	7 45	15 45	24 45	12 45	32 45	40	49	43	47 45	42	34 35	33 32	21	-27	6	-198 3			
5	-12	-11	-4		2	12	7	5	11	В	7	27 42	19	15	29 41	34	34	47	47 36	41 26	47 16	26 5	-155 2			
N=	85	28	41	42	42	42 B	4.P A	+2 13	42 21	+2 19	20	22	15	14	26	32	64	77	66	48	15		-400			
#=	42	42	-21 41	-3 48	48	. 48	4 A	48	48	48	4A	47	47	45	44	44	42	38	34	24	15	5				
7 N#	-20 38	-13 37	43	-3	44	3 44	44	11	18 43		12 43	13 43	14	9 +1	30 41	41 39	67 37	36 ·	· 30	48 20	13	5			•	
8	-27	3		-3		-1	7	3	9			9	16 70	12 70	j 4 6-8		39 60	33 55	30 46	33 31	-13 21	-2 6	-77 3		,	
N=	52		66	68	70	70	70	70 26	70		70 30	70 23	71	31	56		**	40	. 28	. 10	36	43	30	-390	1	
N=	36	-61 36	-10 54	75	55	45	94 90	54	54	54	54	54	52	52	52	51	46		40	31				1		
10 He	*## 53	-16 59	-16 51	-33	-31 62	-20		-20			56	6	40	5 57	-1 55		29 53	17 50	40	5.8 4.0	55		-115 8			
11	-53	-54	-57							-131	-186	-123	-119	-118	-107	-A8	-A4	-94 55	-96 50	-106 39				-470		
N=	53		71	72		-167		-300		69 -179	49	69						-43	-59				-379			
N=	73							-500			92	92	50	. 90	88						- 34					

			VERT!	CAL :	PROF 1	LES OF	F MON	THLY I	MFBN 4	4E F 10:	IONAL	WIND	AND	NUMBE	A DF	OBSER	PATIO	4S. 2	O TO 1	70 KM	FOR	PRIME	POSE			
					RECO												M/SEC				•					
MONT	HZLFY	/FI				30KM					6 DKM					SOKH				•	SQKM					70KM
1	-65	-74	-84			-17		-8H	• 75 29	-80 28	-82 28	-66 27	-43 25	-81 22	-60 21	-56 21	-53 21	-54 19	-76 18	32 16	11 ·	37 4	245			
N=	28 -43	28 -50	28 -53	-60 -85	28 -46	28 -57	-78	2P -54	-50		-16	-27	-43	-+8	-39	-31	-20	-25 24	32 24	73 19	135	139	226	207	403 3	443
N=	26	26	26	26	27	27	27	27 -47	27 -47	27 -58	27 -58	26 -51	25 -41	25 -29	25 10	25 34	25 58	67	108	155	278	310	293	380	710	
N=	-18 20	-13	20 20	20	-27 20	-35 20	-45 20	50	20	21	21	21	70	20	50	19	19	18	17	11 109	8 154	6	174	246	314	462
4 Ne	10 27	20 26	21 26	56 10	26 26	16 26	32 25	24 24	30 24	38 24	38 24	30 24	46 23	71 23	76 23	76 23	85 22	25 90	22	50	17	11	9	7	7	•
S No	-7 36	-A 34	6 34	12 34	34	1 34	2 34	3 34	-1 34	12 34	-A 34	9 33	12 31	* 30	20 30	23 29	37 27	64 27	92 24	85 24	16	130	212	222	382	1
6	-30	-4	-A	2	4	7	14	15	71	25	34 15	30 15	17 15	26 15	55 15	56 15	65 15	85 15	109 12	99 11	124	109	175 4	230 2	360 1	
H=	16	15	15	15	15	,15 A	15	15 26	15 29	15 21	7	32	27	14	,	40	98	83	85	101	66 B	221	196	356	422	
7 H=	20	50	50	50	20	20	19	19	10	18	16	18	16 52	13	13 25	11 62	10	107	109	127	147	"	215	257	275	620
8 N=	8 35	9 36	36 2	11 36	15 36	35	17 35	35	15	20 35	23 75	52 35	15	34	34	34	32	31	30	56	23	21	15	12	400	2 530
g Nø	-0 31	.13 .31	10	3 31	12 31	31	13 31	30	26 30	31 31	40 28	46 27	6.5 76	48 26	53 24	57 22	50 93	160	112	17	116	10	7	5	3	5
10	-6	-20	-18	-15		-30	- 1A 20	-46 20	- 36	*6	-2 20	20	-1 21	17	26 21	65 20	46 19	70 14	82 16	96 15	13	145 11	164	205	316	
11	-A	7 0. -17	20	21 -45	21 -68	-70	- 86	-/5	-101	-99	-121	-107	-98	-91	-61 15	29 13	-8 13	7	67 11	41	54	45	120	-30 i	30 L	230 1.
N=	16	įΑ	17	17		17		17	17	-117	-186	16 -226	-174	-153	-187	-159	-163		٠.,	-92	-22	167	315	160		
M= [5	10	10	10.	10	10	10	10	10	10	10	11	10	10	10	10	10	•	*	7	•	٠	3	•	•		

			VERT	[CAL	PROF [I	LES N	F MON	THLY	MEAN I	MER IO	10NAL	WIND	AND	NUMBE	A OF	OPSER	OITAV	N\$+-2	0 TO	70 KM	FOR	VOL GO	GRAD	
			PERI	no of	RECO	RD 9.	/65 T	0 1/	70 '	LATI	TUDE	49	LANG	(TUOE	-45	0	H/5EC	TIME	S TEN	1				
MON	TH/LF	YFL				10KH					40K#			•		50K#					FOKM			TOKM
L N=	25 13	44 13	11	5A 17	40 13	64 1 1	11	65 11	-12 13	-16 11	11	104 17	190	86 12	-45 10	-14 10	lé h	3	-390 1	-820				
2 N•	-32 10	-19 10	-22 10	-10 10	1 / 10	5 6 1 D	4 l 10	10	10	10 24	10	10	10	₹1 10	10	10	-15	-1.1						
3 N=	6	-27	21 4	-43 6	-19 6	-) 1 6	3	~ l ~	-74	-5 !	-31 6	-36 6	-111	-204 6	-100 6	-50	70 5	191						
N	-13 14	-20 14	-28 14	-2† 14	-37 14	14	-25 14	-4 34	+21 13	12 : 13	22	64 13	75 13	18	17 13	43	18 9	72	130					
5 N=	15 11	-1 11	-11	-15 11	70 11	11	57 11	5 10	-11 10	-25 10	32 - 4	49 9	4 1	2 9	-8 9	18	63 6	147						
6 N=	19 10	10 54	2 10	-) 10	35 10	16 10	-18 10	-21 10	10 56	-51	61 9	194	145 8	-45 6	-158 6	-53 6	-88 5	-36 5	-13 3	200 1				
7 N=	1 14	я) 4	5 14	-14 14	23 14	-22 14	-27 14	-22 14	14 14	-29 14	14	-12 14	-34 14	-86 13	-68 11	11	99 10	195	21 4 5	170				
N= .	30 4	1 A	35 4	28 4	42	4 0	43	40	52 4	85 4	67	57 4	42 4	-100 1	-110 1	-110								
9 N=	- 5 11	-10 11	11	11	11	12 11	73 11	11	50 11	40 11	33 11	11	16	5	36 \$	23 9	-40 5	-5h 5	10					
10 N=	-24 15	-1 15	-17 15	1 n 1 6	10	56 16	1? 16	91 41	38 16	13	9 15	11 15	55 14	99 14	109	111	47	15 8	160	1				
1 I N-	-13 17	-1 2 17	-29 17	. 44 17	17) 7	-17 17	-11 17	49 17	97 17	68 16	-B 16		5¶ 16	-6 15	74 14	+70	-164 7		-25	145			
12 N=	35 16	43 16	56 16	36 16	90 16	128 16	44 16	104 16) 6 150	128 16	103 In	21 15		-118 15	-47 14	*14 11	-2 19	-2 B	43	10	140	290 1	420	

			ue DT I	EAL F	HOF 11	FS OF	MONT	HLY F	(FAN	MF H TO	ONAL	41 NO	AND 4	NUMBER	OF C)432A0	OLTAV	NS+ 3	Q7 0	70 KM	FOR	WALL	OPS			
					HECOH		•			LATE		18		I TUDE	76	O	4/SEC	TIME	S TEN	ı						
						- -					40KM				į	5@KH				1	60KM					TOKM
MON	M/LFV	EL									•					201	223	226	216	197	228	220		-243	-278	-353
l N=	12 52	11 52	A 54	15 55	45 58	53 59	50	4 A 5 3	4 D 4 S	69	109 65	64	159 43	63	61	5A	50	+6	39	34	25	18	Ħ	1	ı	1
2 N=	13	12	16 57	19 59	27 58	27 59	17	2 61	-6 51	63	33 63	57 66.	AB 63	117 61	13A 59	141 54	146 52	146 41	139 38	101 30	67 25	25 20	13	-132 .6	-78 2	-56 l
3 N=	3	A 66	11 67	10 67	18 68	10 68	5	3 69	-10 70	6 71	1 i 71	32 70	53 70	53 70	62 69	47 64	45 56	72 47	76 36	73 24	80 18	136	71			
4 N=	-17 76	76	77	11 78	13 78	16 79	15 79	79	2 79	7 78	17 78	26 78	33 78	39 78	44 77	45 75	55 71	74 64	72 52	76 43	49 30	89 14	10	65	51 2	130
5 N=	1 81	6 82	4 A3	83	1 93	1 n 83	01 FA	11 H3	6 52	3.8	11 A1	20 81	74 AQ	35 80	44 80	54 78	59 74	62 70	48 54	14 43	11 29	20 15	13	-18 6	-99	
6 N#	-7 80	4 80	6 80	7 81	2	10 82	10	9 63	11 93	83	9 92	17 81	34 78	52 77	55 77	49 73	38 66	9.U 58	23 52	39 38	+2 27	28 16	38 11	74 6	121	35 1
7 Na	3	7 84	5	2 84	6 94	16 85	10 45	7 85	2 85	2 84	22 88	16 85	1 4 A 5	41 84	47 A4	48 82	51 76	47 62	33 51	33 39	15 32	13	64			
B No	9 98	2	100	100	2	4 501	8 102	1+ 101	10 111	105 3	105	100	23 100	37 97	48 93	35 96	9 80	22 71	43 54	20 38	11	12 12	73 6	3	117	3
Q Nu	76	1 74	76	74	-0 7H	7A	,6 19	6 79	† 80	5 70	9 79	17 78	30 77	3A 77	54 75	47 72	73 61	83 55	61 39	53 26	50 15	-8 6	-+6 3	10		_
10	6	16	. 13	23 75	79 77	31	35 #D	39 #1	75 A I	30 8.8	40 47	AO Hì	40 76	6A 7.8	85 78	90 76	75 69	81 57	80 45	58 33	69 21	13	-27	-54	-A0	1
11	11	16	30	3A 8A	43 57	42	^ i	44 60	79 60	4.7 60	60	97 59	141	156 54	181 54	179 51	180	164 40	155	124 23	8 I	11	14	-43	-58	157
	7'		_,,,																							44

			ueut	7681	PHAF 11	ES OF	MON	HLY P	4FAH 1	4E 4 E 0 1	CONAL	WIND	AND 1	NUMBER	of	OBSER\	40 TAV	NS+ 26	10	то ки	, FOR	PT,MU	ю			
													LANG				4/5EC	TIME	S TEN	F						
						30KM			,		40KM					50KM				4	60KM					70KM
-	TH/LF									18	27	42	54	75	97	118	117	114	123	116	135			220	113	
. 1	-17	-17	-13	119	155	122	122	151	125	123	123	123	123	120	114	114	109	75	-91	60	37	20	12	,	•	
,,-	-9		- 25							-0	-17	3	79	53	74 106	78 105	79 97	67 90	73	79 46	65 33	92 18	87	120		
N=	108		110		110	110	110	110	110	110	110	110	110) QH	140	107							230	40	-150	-240
3	-14	110	119	119	13 119	114	/4 119	39 119	29 119	12 119	3 118	11 116	117	54 116	116	112	109	75 91	49	45	29	11	ì	ĭ	ī	ï
	14	Α.		11	н	10	15	22	71	7	-16		12 149	. 44	56	52	41 135	26 111	38 89	4 Z 6 R	31 37	-4 12	9	-30 6	-69 6	-101 6
N=	148	149	149	150	151	147	151	151	151	151	191	150	100	144	1 70				_			22	-4	11	17	60
5 Ne	12	-1 161	162	165	7 169	170] 172	15	9 172	172	172	172	171	54 170	167	162	48 156	35 136	102	35 70	29	12	ě	•	•	Ş
6			_	_				14		-	4	6	12	36	49	57	71	64 136	40	19 75	10	54 27	61 20	173	350 1	330
N=	165	166	146	166	166	144	100	167			_		_					63	43	-4	2	32	108	159	210	227
7	20	10	9	5 169	-1 170	171	16 171	13	172	16 172	172	115	172	170	198	63 166	159	145		85	44	26	13	8	•	4
. 8	.11	-1	-0	ı	-1 163	3					,	-4	7	25	44		70	60 135	52 102	31 69	-10 43	-18 24	15	73 6	72	76 5
N=	157																		49			38 15	31 12		-20	-18
N=	144	145	146	148	149	349	150	149	149	149	149	148	147	143	142	137			• • •					49	76	-67
10	+) 150	-A	-6 160	-1 16=	3 166	2 144	26 170	35 170	13 171	16 173	173	171	12	34 172	58 170	167	79 154		151				100		' '	. · · · · ·
11	-8	-6	-14	-4	- 6	l n 4		1.6	21	24	11	•	- 11	2) 100	44		10	95 91	77				-64	-117	-1	30
N# 1 2	10a -17	101		•		- 34	- 49	_4	۵		. 13	17	. 40	67	110	124	139			141	80	59 10	192	14	-1	7 -163
N.	100	110	110	ΙĪŽ	115	112	112	114	114	114	114	111	1 113	113	313	110	103	43	1.4	. 21	• • •					

						E C 08	- MAN	TH1 Y #	4F AN	MERTO	[ONAL	► INO	AND P	NUMBER	0	085EP1	VAT10	45+ 21	0 10	70 KM+	FOR	WSHR				
			Y) RI	(LAL	PFC0					1 471	tune	12	LONG	TUDE	107	ce	4/SEC	TIME	S TEN)						
			PEHT	op af	RFCO	RO L	(61)	1 127				-				SOKA				•	SOK#					70K#
MON	TH/LF	VEL				HHOE					#OKM						168	176	176]+6	152	87	64	65	-97	-63
ı,	14	1	-8	-1	119	50	17	33	32	30	60 118	96 117	110	112	111		103	100	95	89	. 86	71	45	34	•	20
N=	119	116	110	119	114	120					1	21	35	61	76	88	89	81	94	102	82 84	72 69	45 53	-11		-67 11
	-7	-A	-h	124	124	122	172	172	155	-19	118	114	113	110	110	110	110	100	105	95			•-		-107	-24
N=	129				17	16	29	19	7	-11	-1	55	44	63	66	66	59 111	64 108	.S.I	53 91	62 75	56 56	25	-24		11
3 N=	14 129	130	130	10		150	129	130	129	129	156	124	124	155	120	116					89	70	63	34	-6	-37
	17	10	7	g	14	14	13	,12	11	-11	-12	27	5.3	49	154	54 151	42	33 145	136	74 125		100	73	36	55	15
N=	164	164	164	164	164	l∻≤	164	164	104	154	191					151 48		50	21	30	39	58	72	36		-40
5	21	2	6	9		6	19	13	161	159	160	11 159	10 158	38 158	46 157	154	150	149	141	135	125	105	75	43		17
N=	162	163	163	[64					_	_			24	14	51	57	20	76	33		32	56 97	46 72	66 52	37 32	80 18
. 6	16	154	4 158	15A	158	13 158)3 158	159	159	154	157	155	155	153	153	152	150	145	142	137	164	•			-11	25
							_					13	4.8	50	48	37	39	55 132	47 122	112	94	64 78	50 59	40	25	17
	3 157		158	158	5 157	157	154	154	153	153	152	149	149					-			25	18	19	31	-38	147
A	21	4	3	6	6	7	12	- 16	12	9	5	9	28 163	47	55 159	65 155	92 150	53 146	37 138	125	107	78	57	39	16	7
N=	174	174	174	174	175	175	74							24	56	47	56	46	70	61	66	77	70	23		-162 7
9	12	-1	. 7	6	-2 172	172	22 177	172	-5 L72	-1 169	167	164	165	164	161	161		145	136	129	105	65	59	41	19	
N=	171	171	111	112								17	45	66	RA	87	R)		79	115	81 104	67 84	7 L	29 43	76 21	
10	158	158	1 159	159	159	150 150		159	158	156	156	157	149	147	143	140		130	-		• -		• • •	40	43	104
	-1		2	1.0	14	23		+1	3.9	27	19	41	86	91	109	122	135	127	111	119	126	118 68	45	36	16	ě
N=	148	148	148	146	148	LAH	144	144	1 4 R	147						139				135	125	107	110	1+7	133	37
12	11	- 1	- 4	67		.11	32	43	4.1 1.44	1 50 126	4 % 3 2 %	127	184	150	119	137	1	177				59	13	20	13	10
Ne	127	124	124	1 2 9	124	150	1 / 1	177			•••	***														

			VERT	T C GL	PAOF S	ES OF	HON.	THLY P	4E #H	MER10	I OMAL	WIND	AND N	MMBER	i uF (08 5E R\	#01T&V	15. 20	70 7	ro KM+	FOR	KENN	DY				
					RECO								LONG				4/SEC	TIMES	S TENS	١.							
	H/LE	es i				3.DKM					OKM					SOKM				•	HMON					70KM	
1	3	-1	9	16 154	29		46 160	15	181	75 161	29 160	40 158	46 158	87 155	106 151	98 145	85 137	8A 123	94 103	127 72	127	91 19	96 12	54	37	49	
	146	,		24	24	•.		1.6	د.	-4 14 f	1	30	4.5	71	78 142	68 1 10	179	76 110	86 97	80 71	125 46	162 16	116	-93	36 6	67 5	
			130		9 9 12 0			_					k I	155	63 172	70 140	113	4.H 9.9	34 76	61 54	143 31	151 15	80	-84	-44	-44	
								_				ш	24	44	1.1	31 127	34 124	46	93	3A 71	43	114 14	45	26	•	-103 +	
N= 5	-A	110		_	1/E 6 1/5				- 1	- 1	-0	•	2.8	30 110	24	45 104	4.7 98	5 i 9ii	45 76	31 57	,5 36	-20 14	-50	33 5	42	-145 6	
N=	4	DA LD	-4	ı							2		25	46 113	65 111	77 108	7] 98	50 95	31 68	19	5 48	-5 20	-37 8	-77 6	79 6	192	
N= 7	96	10		-17						3	٠,	-10	-2	33 147	50 145	67 141	68 137	63 121	7 L 137	43 94	37 57	-27 25	42 10	149 8	70 9	-10 9	
N= 8	2	131	1	-10	-9	-1						-13	3	28 131	52 128	55 124	67 120	61 114	38 99	47 73	. 76 39	59 27	41 14	-16 -16	-14 8	49	
۰	5 153		2	-2			14	17	10		4	-5	10	30	35 110	46 107	55 49	72 91	64 78	60 63	36 39	-3 16	3 7 9	-26 7	-9 6 7	-63 6	
10		5	108	10	-	11	17 134	10	-10		7	20	15	47 137	60 131	60 127	65 120	51 [04	4 0 90	69 22	24 46	2A 21	5 11	102 3	-57 3	.418 3	
u	5	6	5	22	35	42 119	47	51	37	19	45	65		143 116	164 115	157 115	148 109	149 48	129 79	134 68	135 43	104 30	17 14	200	97 11	6,3	
12	114 -7 124	-7	_	14	31	49	67	79	57		57		70 136	76 135	94 1 10	93 651	9# 11#) 7 1 L U	A0 V2	69 68	43 37	60			40	-19 A	

			VERTI	CAL	PAOFIL	ES OF	HONT	HLY "	E AN	MER 10	ONAL	#1ND	AND	NUMBER	gr I	GASERI	ATION	13+ 20	***	IQ RMS	FLAM	-				
														30UT				TIMES)						
	TH/LEV	, e i				30KM					0KM					SOKM					OKM					70KH
MŲN	IN/LET	ie.							-7	-5		35	12	39	69	53	53	27	70	147	58	16	-123	-108	-154	
N=	-10 71	72	73	16	74	74	74	74	74	74	74	74	7.	39 73	72	53 71	69	65	54	36	15	10		3	•	-
,	-10	-4	5	13	17	10	5	3 65	7	LA	16	33	41	54 63	58 63	54 62	46 59	35 55	67	102 35	66 16	33 A	120			
N=	65	65	45	65	65	65	65	65	45	65	65	65	64	63	93	ÞΕ								•		
3. N=	-5 68	-2 68	6	19	23 69	15 69	7 69	29 69	78 69	34 69	30 69	49 68	64 68	66 68	61 67	48 65	63	59	82 54	36	93 12	-42	-133 3			
	_	•			12	. 12		-5	5	9	3	14	41	4 B	53	46	42	47	77 86	61 65	33 27	5 14	-29 7	-111	-276 3	-291 3
N=	111	เนีย	111	nii	าถ้ำ	112	112	112	112	112	113	113	113	112	109	107	104	99	86	65	-	_	'	• •	_	-
_														60	62	52 111	56 103	48 96	62 76	64 47	94 23	75 15	5	50	-93 3	-380 3
N=	108	114	117	119	120	150	120	151	151	121	121	150	118	117	110	111	Lu3	70						_	-	
6 N≖	6	96	7 98	9	102	5 102	104	12 109	9 114	7 116	118	9 116	26 117	45 114	45 111	109	56 103	70 93	76 75	68 54	31 23	39 12	20 7	-5 6	5	-77 4
	10			6	5	1	23	17	1	4	4		27	44	44	45	67 61	71 76	7¢	94	113	74	-15 11	-86	-70 3	-67
Ne	89	90	91	93	94	96	101	103	105	106	110	111	110	110	108	103	87				-				_	
B N=	12	2 104	106	6 109	110	8 110	13	18 114	10 116	-0 118	118	3 119	30 119	119	114	53 117	78 · 107	90 101	87 80	61	39	55 36	17	9	5	-225
	-4	4	10	6	9	5	16	15	5	5	6	6	19	39	43	44	49 111	54 102	63 69	55 72	57 50	6 25	-24 12	110	184	222 1
H=	117	110	121	121	151	121	151	121	121	121	150	150	150	150	110	116	111		94							
10 No	-5	1 130	3 130	131	6 132	-6 132	1 112	132	112	8 132	331 331	132	135	45 132	132 132	131	121	52 109	56 97	79 65	34	16	10	6	4	*
11 N=	-2 78	-A	a]	12 64	16 84	12	5 86	a7	~2 A7	89 -9	-25 AQ	-2 91	29 91	35 88	46 87	51 85	45 83	4 D 7 0	38 71	51 50	29	76 11	-17	65 3	3	*115
18	-16 A3	-7 63	-0 83	12		β4	-2 84	4 64	1 A 84	13 85	32 87	52 87	7 T # T	96 87	115 A6	132	127 83	120 79	134 63	126 46	162 15	291 7	165	38	-35 2	-50

			VERT	CAL F	PROF I	ES OF	MOM.	THLY I	MEAN	MER IO	IONAL	HIND	AND N	UMBER	OF.	ORSERY	ATIO	15. 21	0 TO	TD KM	FOR	GR, TL	RK_	
			PERI	00 OF	RECO	RD 9,	61 1	0 12/	66	LATE	TUDE	21	LONG	TUDE	71	CM	1/SEC	TIME	S TEN)				
MON	TH/LE	VEL				30KM					+QKM					SOKM				•	DKH			70K#
i Na	-20 11	-43 11	-36 11	25 20	10 21	-17 21	\$1	7 21	-17 ?1	9 21	13 20	59 20	90 20	97 19	62 19	17	13 13	69	32	89				
1	-7 8	-31 A	-29 8	23 13	-1 13	-20 13	11	13 2	-16 13	2 13	50 13	69 13	68 11	10	35 9	30 6	44	120	161	40				
3 N=	-27 18	-41 16	-16 18	19 20	12 20	50 -6	-4 20	50 d	16 20	31 31	5 20	19 19	43 19	54 19	64 19	17	70 15	56 11	29	112 5,	402 2			
4 N=	-8 16	-50 16	+37 16	11 18	12 18	-7 18	-24 18	-20 1 H	-13 17	-22 17	-23 17	28 15	36 15	56 15	54 15	40 14	52 11	110	103	95				
9 N=	-13 6	33 A	38 8	В	1 6	31 6	A	23 R	8 5	-4 9	3 A	33 8	43	24	8 62	92 6	76 5	69	8 <u>1</u>	140				
6 N=	-5 15	9 15	, 15	-3 15	-9 15	15	23 15	A 15	15	5 15	15	-13 14	42 14	54 12	55 10	62 9	54 8	69	67 5	90	-60 1			
7 Na	2 18	35 18	18 81	-9 18	-11 19	-11 19	19 19	10	-3 19	2 19	-5 19	-10 19	17 19	56 18	69 17	15	7 13	82 10	93 7	61				
8 N=	14	-22 14	-15 14	-16 14	-10 14	-1 14	16 [4	-1 14	-9 14	3 14	-35 14	-21 14	18 13	35 13	+3 11	10	22	30 5	184 2	290 1				
9 N=	-15	7 22	23 22	-2 25	-0 26	3 26	-1 26	13 26	9 25	25	-1 25	-6 25	8 24	24 20	39 24	68 22	83 19	*6 13	64 10	173 5	258 2			
10 N=	-5 27		-24 27	22 31	35 3	19	•2 32	1 32	12) 32	6 32	27 32	16 31	28 30	54 66	35 28	16 25	10 24	10 19	10	141	173 1	419 1	
1.1 N#	13	-35 17	-37 13	36 [)	A 13	11	-11 13	15 11	22 13	17 13	-20 13	-17 13	-3 1 t	76 13	13 88	126	142	10	32 10	79 B	210	42B 2		
17	1 10	-13 10	-20 10	10	16 10	14 53	47 10	25 10	4 G 1 (I		56 10	59 18	191	112	84 10	137	4	-13	-36	* 51	1 1 1			

			·			ce ni	- 400	tel Y	4FAN 1	4E#101	ONAL	WIND	AND N	UMBEP	ΩF	OASERV	ATION	15. 21	10 7	0 KM+	FUN	ANTIN	IUA		
					RECOR					LAT]	tuDE	17	LONG1	TURE	62	. 14	175Er	TIMES	5 TENI	•					70KM
			PFHI	10 11					=		4.01/19					50KM				É	OKH				runn
MONT	H/LF	ÆL			3	OKM							43	36	47	63	76	61	85		120				
1		-12		A	6 46	-7 44	-12	-21	-76 47	-19 47	47	42 46	46	45	41	40	33	51	18	7	5				
N=	39	39	39	46		47				- 3	-5	17	29	41	4 H	40	68	19	109	102 13	53	140			
. 2	-12	-27 46	-16	9 48	13 48	48	48	-12 47	-15 47	-2 47	50	50	50	51	47	46	40	56	21						
N=	46	-					3		-16	-17	-10	н	16	26 43	24 40	36 38	62 34	58 28	65 21	32 13	4-8 B	2	-170 1	1	
3 Ne	-19	- 32 44	-1 44	17 46	19 46	46	46	46	45	4 %	46	44,	46	4.3	9 1)					110	120	95	24	-23	-96 -132
	-20	-39	-20	9	1	-3	-1	-5	-6	=6 57	-10 47	14	29	33 49	37 46	36 42	45 37	7 u 25	104	110	6	•	3	2	1 1
H=	46	44	44	47	47	47	47	47	47	•,				21	34	58	66	59	49	73	133	_	-10		
5	-2	4	1	. 1	31	13	17	31	٠ 11	31	31	-11 37	32	30	30	29	56	24	20	15	5	2	•		
M=	31	31	31	31					3	-1		-7	2	27	46	87	98	47	~ <u>i</u>	34	127	~28 1			
6 N=	79	14 30	30 30	1 30	. 30	-3 30	-4 30	29	20	29	54	28	27	26	50	24	I H	12			_	110			
-		-	· .	-0	-1	2	11		-11	9	7	-5	-6 33	-8 29	34	89 22	78 19	66 5	88	6	114		,		
7 N=	34	-7 34	34		14	34	11	34	74	34	34	33					R4	49	34	72	45 2	190			
	3	q	12		1	. 7	A 16	- 7 50	5 16	3 36	-1H	15 35	20 13	22 31	4 II	85 23	20	17	14	5	5	1			
Ne	36	34	14	16	36	36	ייון	-			-1		l۶	44	64	68	76	57	30	13	43	60			
	-1 38	-1 36	6 19	7	-2	44	**	47	42		43	41	40	30	()	36	34	30	10		-				
14.00		-				,	-7	-8	7	15	- 3	-11		12			12 53	21 46	21 21	46 21	- y 9	1 p			
10 No	-9 61	61	10 62	- 5	45	65			A7	68	49	69	AM	66	***				66	111	13				
11	-127	-205	-215	-137	-33	9.3.3		17	10	29			5.3	70 31	13		86 27	7 U 2 L	17	•••	5				
N=	10	30	30	31	33	33	13							43	33	50	73	105			75	100			
12 H=	-7	-11 45	-12 45	18 45	. 13 45	46		43	43	1 42	42			38	39		27	20	15	8	2	1			

							MONI	HIY H	IF AN I	HEH 101	ONAL	m I ND	AND N	UMMEH	aF C	MSERY	ATION	15. 20	10 7	O FM.	FOH	SHFRE	AN		•
					PECU:					LAT11		g	LONG		AĐ	(#	/9EC	TEMES	TENI						
											MND				,	50KM				6	OKM				70KM
HONT	HZLF	YFL.				ICKM			_				21	23	41		76	-13	7	-51	-20	-14	21	390	
. 1	52	11 52	21 51	12	-5 51	-14 51	-12	-10 51	41	17 51	14 51	1 b	ξĎ	44	48	43	19	17	29	\$1	1.0	12	1	•	
No.				-6	-37	-41	-47	-42	-9	-15	-33	12	- 3	10	47	48 19	19	80 19	48	13	-8 10	-28	-87 3		
N=	15 23	10	-7 24	24	24	24	24	24	24	24	54	24	24	6.3		-		- 1		93	43	-7	-2	70	
3	-6	-5	-16	-3	-19	-41	-43	-21 34	-14 34	-11 34	-32 34	-3 34	-16 35	# 35	34 34	58 32	71 30	69 75	80 25	22	17	11	Ă	2	
ŅΦ	33	3.3	33	34	34	3*	34		-4	15	30	12	13	25	20	35	38	78	92	57 33	38 25	72 13	203 3		
4 N=	5 51	9 51	6 51	9 51	13 51	-3 51	-9 51	-20 51	51	54	56	56	57	57	56	55	52	47	+3				_	1.0	
5	2.	-33	11	-3	- i	-6	-14	-14	2	9	35 61	24 60	15 60	27 54	27 58	44 55	41 52	45 51	53 45	37 31	-3 -3	12	109	149 1	
N=	59	60	40	60	60	60	40	60	^ ^0	65	23	39	44	18	* t	75	54	112	108	46	35	106	33	83	-110
6 N=	8 61	21 61) 4 61	-1 61	-0 61	61	-15 61	-13 61	-52 61	-00	60	60	60	60	60	58	57	55	♦ B	40	30	17	В		•
7-	3	-5	6	4	7	14	-20	-7	-10		-7 59	3 59	13 59	28 59	50 49	58 59	46 58	102 53	109	77 38	54 33	L D 24	215 12	190	
N=	55	55	56	59	5.9	59	4,4	49	59		_		24	36	58	51	73	58	60	66	48	21		-120	
. 6	-6	22 47	24 54	6 60	-0 60	+6 60	-]A	-17 40	-13 60		12	60 60	40	59	59	59	59	58	49	39	30	17	9	1	
N= 9	+5 -5	•15 35	ı	-4 35	-10	-33 35	-26 35	-17 15	-B		A 3◆	-12 34	13	21 32	19 31	29 40	35 27	-0 24	19 19	28 18	80 14	7	-27 3		
N= 10	34	37 46	LD	10	5	-6 51	-22 53		i 53			13 53	7 43	16 53	52 52	52 52	47	>¢ +5	81 36	117 30	57 25			105	1
Na	46	98		1/		-1	-4		10			21		•!	7 i		10	16	48 1	9.6 4L	27			10	
11 Ne	•	44	1 44	9.0		. 4.1	9.1		4		ካ፣			\$ 1				-	Į.		59				
i e	-26 91			14 97					41 41	10	11 51	4 1 50		1) 4H	• 1		26		*1	32	25				•

			VERTI	CAL	PROF 11	.ES OF	MON.	14LY 1	4E AN	MEATOI	OHAL	= I ND	AND N	ACMINE F	QF.	ORSEP	40 [TAV	15. 20	10	70 KH	• FDA	KWA.	ALEIN	
					RECOR					LATIT		,	FUNE)				M/SEC							
MON	TH/LF	YFI				3ax4				•	044					SOKM					60KM			TOKM
1	3	-4	16	2	4	5	LA	-5	-1	-3	-5		1 £	72 27	62 62	14 26	35 25	39 24	-9 24	-80	-85 15	-98 9	-102	
N=	27	27	27	28	28	24	79	50	79	28	28	78							-29		-101	-174	-215	
2 Ns	-9 21	-10 21	-5 21	1	11	. 11	72	-16 22	-14 24	2. 24	9 24	-1 24	14 24	58 23	27 21	21 21	73 21	51 13	19	15	10	7	5	
3	-4	16	- 3	6	26 28	- 3	-3 28	-2	-6 28	30 26	35 28	75 26	78	3 26	24 28	57 27	73 28	33 28	37 25	21 19	22 14	- 8 B	-150 3	
No.	26 101	2A 147	2A 39	2#	н	А	3	- A	6	21,	24	41 20	66 20	5+ 20	50 20	89 19	5 i	-6 14	-33	-51 8	-56 5	-80 3		
N=	20	13	SŦ	21	21	ST	12	22	72	50	20					43	42	29	14	-32	-42	-50	100	
S N#	5 19	-10 14	19	19	1 14	5 14	10	-7 19	19	19	19	20 19	26 14	39 19	56 19	19	19	18	iř	12	6	3	1	
6 N=	3	26	-1 24	g, 24	-3 24	4 24	16 25	-11 25	3 25	. 21 25	15 25	16 25	25 25	31 24	42 24	49 24	49 23	12 23	-20 22	-40 19	11	-14	. 8	
7 N=	-3 21	14	اج ا	21	14 21	21	47	, 23	7 23	11	÷2 21	23	22 23	53 54	23 35	49 25	40 22	64 20	35 18	-28 11	-21 1	-190 I		
8 N=	-1	35	32	18	-9 32	-4 37	-7 32	-13	-17 32	3 32	12 32	28 12	72 32	96 SE	43 32	\$1 31	66 31	39 26	į 7 25	-37 21	-78 13			
9 N=	-0 33	-12	9	8 33	33	-2 31	-13 33	-6 33	6 3.1	12 13	5 33	1? 33	73 13	32	16 32	35 55	56 32	61 31	23 30	-32 22	-105 12	~30 1		
10 H=	2	1 3 30	-0 30	-1 30	2 30	- I 30	- ? 30	-5 30	30	L3 .30	-A 30	-15 30	19	38 30	62 30	64 30	40 30	30	-6 -6	55 15	-53 17	-52 9	- 30 3	-70 1
§1 N=	6	-6 13	-4 13	-15 13	-2 13	3 13	-10 13	-17 13	-1 13		1 14	22 14	58 14	21 14	33 14	10 14	32 14	40 13	42 13	25 1 L	8 11	6		
12	18	23	-1 23	8 23	17 23	23	11 23	.23	6 23	5 21	-12 22	27 27	75 72	75 23	27 21	50 45	9 9	16 32	69 18		-22 12	-127 4	30	

			VERT	CAL I	PROFIL	45 OF	: ⊬on1	HLY *	EAN	HERIDI	ONAL	■IND	AND P	NABER	a at	OBSER	4A T D#	15+ 20	70	ro KM	. FOR	ASCE	NS LON			
					PF C (1					LATIT		-8	LONG		15		#/SEC									
MON'	HZLEV	er L				MADE				4	ORM					50KM				1	6,0KM					70KM
1	-0	26	5	-30	-9	-,-	3	15	10	9	-5	-18	- 13 65	-60 65	-78 64	-93 66	-12 62	-51 58	-11 56	-13 47	~30 23	-11 11	16	83 3	235	195
N+	61	61	5 l	66	66	56	66	66	56	66	46	00				-66	-64	-41	-28	-33	-61	-97	-71	26	58	140
2 N=	2 83	2A 83	10 65	-20 85	-14 85	-A 85	+3	ь 85	R5	9 85	A 45	87	-11 RB	-31 88	67	89	89	84	92	62	34	į.		5	•	•
3 N=	9	49	32	-3n 65	-23 67	-10	1 n	15 67	A 67	-4 69	6 75	11 60	17	-6 75	-+1 74	-54 73	-51 72	5#= 98	-23 61	-31 50	-51 25	+70 14	-24 6	-249 5	39 4	5 105
,,_ 4 Ma	5 63	13	13	-6 69	- <u>4</u>	-9 70	-1 70	55	A 77	14 #1	26 85	28 84	70 83	5 82	-16 81	+24 80	-22 78	1 75	63 63	15 50	-38 28	-104 17	-86 12	15 5	-1 l l	-237
5	10	13	5 61	7 65	-8 65	. J 65	15	13	17	27 73	34 73	38 73	36 73	30 73	19 73	-1 73	-12	14	66 66	7 57	-16 35	-89 17	-179 Q	-78 6	29 6	9
N= 6	41 -5	-42	-47	-32 70	-12 73	8 7 L	-7 11	-5 73	14	, B 73	17	19	20 71	52	3 68	-19	-11 65	-13 62	+15 59	-30 51	-92	-129 10	-177	-90 1	-170 1	-100 1
N= 7 N=	68	-9 94	6H 6	, v 2 95	98	4 9A	11 100	4 100	9 100	15 99	23	28	26 98	26 95	7 94	-24 91	-36 90	-20 84	-1 77	-9 67	-28 35	36 15	92 6	167	168	70
A Na	93	12	7	-9 93	-6 95	"" 19	-0 100	96	1 95	13	21	25 94	74 E P	18 92	-4 92	-29	-46 AA	-31 87	-3 84	-4 68	-26 41	22	29 13	244	95 2	-550
• •	-0 83	A3	-4 A 1	-10 A4	-9	-4 H/	-3	ų H7	i A7	3	4 87	9 87	15	# R6	-17 A5	-45 #5	-45 84	-34 AD	-17 74	-1 57	35	5 13	-15 7	3	-27 3	51 3
10	3 106	106	106	л. р. о і і	-16 110	-15 111	112	-1 [1]	8	14	9	11	-12 112	-30 112	-+0 110	- 39	- 35 107	-3/ 102	+32 89	+42 68	-47 34	-31 15	- 36 5	26	55 4	60
11 N=	-9 98	-A	-9 90	-1 93	-14	-6 95	10]4	18	15	27	27	25 92	2	-24 92	-32	-33 19	-37 67	-39 60		-50 0	-47 15		29 7	-16 5	
12	-10 63	-# 63	-8 63	-20 66	-4	-4 69	-1 66	5 66	A 65	-1 65	-2 65	7 65	44	-24 64	-3B 64	-50 64	-45 62	-66 61	-69 55			-135 le			91	107

APPENDIX B: MONTHLY MEAN MERIDIONAL WINDS NEAREST 90°W AT 5° LATITUDE

AND 10 KM INTERVALS

20	KM

LAT.	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
80	-7	-12	-4	- 3	0	0	0	-1	1	. 0	- 7	-7
75	-8	-10	-4	-3	Ļ	1	1	-1	1	0	-5	-5
70	-8	-9	- 5	-3	I	1	1	-1	1	1	-4	- 5
65	-8	-8	-4	-2	l.	0	0	-1	1	-1.	-3	- 5
60	-8	-6	-4	-2	- 1	-2	-1	-2	-1	-2	-2	- 5
5 5	-6	-4	-2	-2	- 1	-3	-1	-1	0	-1	-1	-4
50	-4	- 3	-1	-1	-1	-1	0	-1	0	0	-1	-3
45	-2	-1	0	-1	0	-1	0	0	. 0	0	-1	-3
40	1	1	1	-1	0	-1	0	0	0	1	1	-1
35	2	0	1	0	1	1	1	1	1	1	1	-1
30	2	1	1	1	0	1	1	1	1	0	1	0
25	0	0	-1	-1	-1	0	. 0	0	0	0	1	-1
20	-1	-1	-2	-1	-1	0	1	0	-1	0	0	-1
15	-1	-1	-2	-1	0	0	0	0	-1	-1	-2	-1
10	0	-1	-1	0	0	1	0	-1	-1	0	0	-2

30 KM

LAT.	JAN	FEB	MAR	A PR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
80	-18	-25	-14	6	0	0	0	1	1	-16	-24	-8
75	-18	-23	~ 15	- 6	0	1	0	1	1.	-10	-21	-8
70	-18	-19	-12	~ 4	1.	1	1	1	1	- 5	~ 15	-9
65	-17	-14	-8	-2	1	2	1	1	1	-3	-12	-12
60	-16	-12	- 5	0	1	1	1	1	1	-3	-9	-16
55	-8	- 7	-4	1	0	1	1	2	. 1	-3	-8	-14
50	-4	-4	-3	1	-1	0	1	1	1	-1	-6	-7
45	-2	-2	-1	1	0	0	1	1	1	1	-3	-2
40	3	1	-1	1	1	1	1	1	0	3	1	3
35	4	1.	1	1	1	1	1	1	· 0	2	1	4
30	3	2	2	1	1	1	1	1	1	2	2	4
25	2	2	2	1	1	1	0	1	. 1	1	3	3
20	1	2	1	0	1	0	0	1	1	0	1	2
15	0	1	1	0	0	-1	1	1	. 0	0	-1	1
10	-1	-1	0	0	-1	-1	0	0	-2	- 1 .	0	.0

APPENDIX B: (CONT'D)

					<u>40</u>	KM						
LAT.	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
80	-27	-35	-	-	- ,		-	2	-	-28	-	-15
75	-26	-30	-21	-3	4	1	2	3	2	-25	-28	-14
70	-24	-2 5	-13	-3	3	1	2	2	2	-17	-24	-16
65	-20	-19	-8	-2	2	2	2	1	2	-8	-17	-22
60	-16	-12	-7	1	1	2	1	1	3	- 3	-13	-19
55	-8	-4	- 6	3	1	3	1	2	4	-1	-11	-18
50	-4	-2	-4	4	1	3	1	2	4	2	- 5	- 8
45	0	-1	-2	4	1	2	2	1	3	5	1	2
40	10	1	1	3	1	1	2	1	1	5	5	8
35	9	2	1	1	0	1	1	1	1	3	5	9
30	5	2	0	1	0	1	-1	1	1	2	3	8
25	4	2	0	0	0	0	0	0	1	1	2	6
20	3	1	1	-1	0	0	-1	-2	0	1	_	4
15	3	-1	-1	-1	1	1	-1	-2	0	-1		2
10	2	-1	-2	2	2	1	0	0	1	0	2	3
					<u>50</u>	KM						
LAT.	JAN					•						
	Q	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
80	-34	-28		_	-	-	-	5	_	-18	_	-12
7 5	-34 -28	-28 -26	-17	- 5	- 2	- 3	- 5	5 5	- 5	-18 -14	- -27	-12 -13
75 70	-34 -28 -23	-28 -26 -22	-17 -10	- 5 5	- 2 2	- 3 3	- 5 5	5 5 5	- 5 5	-18 -14 -10	- -27 -23	-12 -13 -16
75 70 65	-34 -28 -23 -18	-28 -26 -22 -17	-17 -10 -7	5 5 3	- 2 2 3	- 3 3 4	- 5 5 5	5 5 5 4	- 5 5 6	-18 -14 -10 -7	- -27 -23 -18	-12 -13 -16 -18
75 70 65 60	-34 -28 -23 -18 -10	-28 -26 -22 -17 -8	-17 -10 -7 -3	5 5 3 3	2 2 3 3	3 3 4 5	- 5 5 5 4	5 5 5 4 3	- 5 5 6 6	-18 -14 -10 -7 -2	- -27 -23 -18 -11	-12 -13 -16 -18
75 70 65 60 55	-34 -28 -23 -18 -10 -6	-28 -26 -22 -17 -8 -2	-17 -10 -7 -3 3	5 5 3 3 7	2 2 3 3 3	3 3 4 5 6	5 5 5 4 5	5 5 5 4 3 3	5 5 6 6	-18 -14 -10 -7 -2 3	- -27 -23 -18 -11 -3	-12 -13 -16 -18 -18
75 70 65 60 55 50	-34 -28 -23 -18 -10 -6 0	-28 -26 -22 -17 -8 -2	-17 -10 -7 -3 3	5 5 3 3 7 8	2 2 3 3 3 3	3 3 4 5 6 7	5 5 5 4 5	5 5 4 3 3	- 5 5 6 6 6 6	-18 -14 -10 -7 -2 3 6	- -27 -23 -18 -11 -3 5	-12 -13 -16 -18 -18 -16 -6
75 70 65 60 55 50 45	-34 -28 -23 -18 -10 -6 0	-28 -26 -22 -17 -8 -2 2	-17 -10 -7 -3 3 5	5 5 3 3 7 8 7	2 2 3 3 3 3 4	3 3 4 5 6 7 6	5 5 5 4 5 5	5 5 4 3 2 2	5 5 6 6 6 6	-18 -14 -10 -7 -2 3 6	-27 -23 -18 -11 -3 5	-12 -13 -16 -18 -18 -16 -6 7
75 70 65 60 55 50 45 40	-34 -28 -23 -18 -10 -6 0 9	-28 -26 -22 -17 -8 -2 2 10	-17 -10 -7 -3 3 5 7	5 5 3 3 7 8 7 6	2 2 3 3 3 3 4 4	3 3 4 5 6 7 6 5	5 5 5 4 5 5 5	5 5 4 3 3 2 2 4	5 5 6 6 6 6 6	-18 -14 -10 -7 -2 3 6 6	- -27 -23 -18 -11 -3 5 10	-12 -13 -16 -18 -18 -16 -6 7
75 70 65 60 55 50 45 40 35	-34 -28 -23 -18 -10 -6 0 9 18	-28 -26 -22 -17 -8 -2 2 10 13	-17 -10 -7 -3 3 5 7 7	5 5 3 7 8 7 6 4	2 2 3 3 3 4 4 5	3 3 4 5 6 7 6 5 6	5 5 5 4 5 5 5 6	5 5 4 3 3 2 2 4 6	5 5 6 6 6 6 6 6 5	-18 -14 -10 -7 -2 3 6 6 7	- -27 -23 -18 -11 -3 5 10 16 15	-12 -13 -16 -18 -18 -16 -6 7 15
75 70 65 60 55 50 45 40 35	-34 -28 -23 -18 -10 -6 0 9 18 18	-28 -26 -22 -17 -8 -2 2 10 13 10 8	-17 -10 -7 -3 3 5 7 7 7	5 5 3 3 7 8 7 6 4	2 2 3 3 3 4 4 5 5	3 3 4 5 6 7 6 5 6 6	5 5 5 4 5 5 5 6 6	5 5 4 3 3 2 2 4 6 6	- 5 5 6 6 6 6 6 5 5	-18 -14 -10 -7 -2 3 6 6 7 8	- -27 -23 -18 -11 -3 5 10 16 15	-12 -13 -16 -18 -18 -16 -6 7 15 15
75 70 65 60 55 50 45 40 35 30 25	-34 -28 -23 -18 -10 -6 0 9 18 18	-28 -26 -22 -17 -8 -2 2 10 13 10 8 7	-17 -10 -7 -3 3 5 7 7 7 6 6	5 5 3 7 8 7 6 4 4	2 2 3 3 3 4 4 5 5	3 3 4 5 6 7 6 5 6 7	5 5 5 4 5 5 5 6 6 6	5 5 5 4 3 2 2 4 6 6	- 5 5 6 6 6 6 6 5 5 5	-18 -14 -10 -7 -2 3 6 6 7 8 8	- -27 -23 -18 -11 -3 5 10 16 15 13	-12 -13 -16 -18 -18 -16 -6 7 15 15
75 70 65 60 55 50 45 40 35 30 25 20	-34 -28 -23 -18 -10 -6 0 9 18 18 15 9 8	-28 -26 -22 -17 -8 -2 2 10 13 10 8 7	-17 -10 -7 -3 3 5 7 7 7 6 6	5 5 3 7 8 7 6 4 4 4 5	2 2 3 3 3 4 4 5 5 6	3 3 4 5 6 7 6 5 6 7 6	5 5 5 5 5 5 5 6 6 6 6	5 5 5 4 3 3 2 2 4 6 6 5	- 5 5 6 6 6 6 6 5 5 5 5 5	-18 -14 -10 -7 -2 3 6 6 7 8 8 5	-27 -23 -18 -11 -3 5 10 16 15 13 11	-12 -13 -16 -18 -18 -16 -6 7 15 11 8 7
75 70 65 60 55 50 45 40 35 30 25	-34 -28 -23 -18 -10 -6 0 9 18 18	-28 -26 -22 -17 -8 -2 2 10 13 10 8 7	-17 -10 -7 -3 3 5 7 7 7 6 6	5 5 3 7 8 7 6 4 4	2 2 3 3 3 4 4 5 5	3 3 4 5 6 7 6 5 6 7	5 5 5 4 5 5 5 6 6 6	5 5 5 4 3 2 2 4 6 6	- 5 5 6 6 6 6 6 5 5 5	-18 -14 -10 -7 -2 3 6 6 7 8 8	- -27 -23 -18 -11 -3 5 10 16 15 13	-12 -13 -16 -18 -18 -16 -6 7 15 15

APPENDIX B: (CONT'D)

60	KM
60	

LAT.	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	VOV	DEC
80	-22	-19	_	_	_	_	-	8	-	-4	_	-
75	-20	-18	-15	11	2	5	2	8	3 -	-4	-15	-
70	-14	-18	-8	11	6	7	5	8	5	-2	-14	-
65	-12	-16	3	12	7	9	8	7	6	0	-12	-14
60	- 7	- 5	-i	11	7	6	5	4	6	3	-10	-16
55	2	7	6	12	7	10	4	5	8	8	5	-13
50	11	14	. 6	12	5	5	4	3	7	8	6	-4
45	19	15	7	10	3	4	3	3	6	7	6	7
40	23	9	8	. 8	1	4	2	1	• 5	7	8	11
35	20	7	8	7	1	3	1	1	. 5.	8	10	12
30	13	7	6	7	2	3	3	4	4 -	8	12	10
25	8	8	7	. 5	5	3	5	6	- 5	3	12	. 8
20	8	8	6	6	8	2	6	. 5	6	4	10	9
15	6	5	5	6	9	2	7	5	6	5	8	8
10	3	3	4	5	5	4	5	5	7	6	5	6

APPENDIX C: THREE YEAR (1969-1971) MONTHLY MEANS AND STANDARD DEVIATIONS, MERIDIONAL WINDS, 20-80 KM, AT 2 KM INTERVALS.

			,				,						C	-2						٠.,					
			HON	(FHLY	MF, AN	HEHIC) (ON A (. WINC	NUF	49EP 0	F OR	SERVAT	10NS	AND	5 1 AND	ARD O	ENTT	I DNS 1	20 T	G 70	км, F	06 <u>68</u>	<u>EEL</u> Y		
			PER	ton r	F AF	-		¥0 12	771	LAT	ITUOE	64	LD8	IG 1 T UD	E 146		(M/SE	C TIM	ES TEI	N)			-		
но	NTHZE	FYEL				70KF	•				4066					50KM					50KH				70FM
N=	30 43		7 30 56	36	25		55	29 29 182	29 23	7 -64 29 274	-61 29 343	7 -164 26 396	-134 26 464	-154 - 24 - 536	-162 23 574	-118 23 572	-74 21 580	-101 16 609	-234 15 396	-167 10 529	-264 6 553	-249 l			
N=	~12 23 75		-24 23 75	23	23	53	23	23	23	23	23	1 23	23	198 53 -506	23	23	22	20	15	10	5	J			
3 N=	-1 22 39	-1+ 22 +6	-33 22 56	22	22	22	. 55	22	22	. 55	22	22	22	-150 19 159	18	18	17	16	-103 14 108	-64 8 80	13 53				
4 N=	32 35 44	21 35 36	15 35 36	35 36	35 43	51	35		35	35	-39 36 119	36	35	3+	5 33 150	10 31 167	53 29 134	43 27 167	208 21 156	39 14 84	30 128	210 1	140		
5 N=	27 28 42	21 28 16	19 28 20	28	21	28 27	26	28	34	28 39	42	26	50	26 50	18 26 77	31 26 73	67 26 86	53 23 87	81 21 113	16 16 131	10 6 155	40A 5 309	-9 1		
6 Ne	14 21 42	10 21 50	17 21 9	16	. 13	1 1 2 1 2 2	21 12	21 15	21	22		22	74 72 42	22	27 22 77	56 22 77	49 21 65	46 21 82	80 20 115	67 16 185	143 15 126	147 7 102	60		
7 N#	10 20 29	15 20 13	8 20 13	20	20 16	14	20 14	20 14	20	55		26 25	21	25	29 18 23	39 17 49	64 17 50	79 14 99	69 10 44	12† 9 95	114 5 86	43 17	2 150	ı	
e N=	52 26 172	26 24	26 26	56	26 19	26 25	26 28	26 33	26 26	23	1 26 27	41	39	26	62 62	-11 24 81	23 100	-21 23 167	21 184.	192 19	176	6? 6 25?	270	1 AO	
N=	17 32	7 17 28	17 22			16 17 55	17	17	23 17 45	17	7 11 38		20 17 58	44 15 67	57 15 79	54 15 66	15 53	78 13 110		11		139	1 1) 120	
10 N=	21 11 34	13 13 47	1 1 49	13 69	71	161	111	154	121	129	100	94	104	81	115	165 185	1 10	220 M	-14 6 276	120	1	60 I			
11	17 84	-90 17 94	-65 17 99	17 99	17 95	121	17 137	160	16 199	1175	16 174	16 198	16 113	-217 16 397	16 411	15 227	14 359	10		233	-54 2 175	-459			
12 N=	12 126		-9 12 94	12	12	13	14	14	15	15	1+	1.4	14	-387 12 501	10	10	10	10	9	7	6	-102 3 +0	70 2 330		
			MON	THLY	MEAN	HERID	IONAL	MIND	, NUM	8E# 0	F OAS	EPVAT	CONS,	AND S	ST NND A	IAD DE	TVIATI	ONS.	20 TQ	70 H	(M. FC)A CHI	IRCHIL	.L	
			PER	1 00 a	F REC		1/69	TO 12	/7]	LAT		59	LON	GITUDE	94	1	M/5E/	TIME	S TEN	n :		-		-	
	ITH/LE					30KM					40KN					50K#					6DKM				70KM
N=	28 65	-40 28 67	-59 44 91	-76 44 92	124	45 139	156	172	45 198		45 238	45 239	45 243	-44 45 263	-54 44 295	-21 44 288	-20 +3 270	-4 39 247	-11 29 250	-69 21 239		-23A 14 271	5	- 199 1	
N=	-115 19 96	-59 19 343	-82 29 76	-78 29 84	-79 29 94	-88 29 99	110	-72 29 133	148	-39 29 164	-31 29 189		29 276	19 29 240	7 29 244	37 29 236	212 29 212	-17 25 156	22 140	17	-113 16 192	10	7	159	
3 N=	-27 22 33	-33 22 59	-30 29 51	-36 29 55	45 29 61	-53 29 73	-50 29 76	-63 29 101	-72 29 120	126 126	-65 29 132	-48 29 146	-53 29 157	-58 29 165	192 -43	-+1 29 179	-23 27 209	-27 25 202	215 215	62 18 217	14	-101 7 158	1		
ĸÌ	14 68	216	21 35	~10 21 45	21 43	21 46	21 55	1 21 50	13 21 56	21 52	35 21 58	23 21 53	31 21 62	35 21 63	20 21 56	29 77	36 21 67	17 20 86	14 19 77	16 92	-24 11 129		04 1		•
N=	-11 12 17	-A 12 39	24 18	25 27	25 22	25 40	25 40	3 30	25 50	10 25 35	7 75 10	26 25 41	20 25 47	25 35	23 25 51	35 25 63	28 25 Al	4H 25 111	46 24 10	39 21 103	45 17 107	4	-154 /		
N=	-23 7 26	-23 7 21	12	13	13 21	13 15	14 13 - 26	17 13 20	72 13 29	11	13 71	14 13 36	13 •2	13 33	13	13 104	64 12 73	15 15 99	60 12 69	76 10 48	6 6 82	-57 12A	- 394 1		
7 N=	-3 8 26	-7 R 18	19	7 14 20	1+ 16	14 14 25	12 14 26	14 22	18 14 26	14 24	-3 14 36	21 14 45	24 14 48	14 14 36	12 14 34	16 14 43	65 14 40	86 14 65	88 63	56 12 91	50 10 104	-3 5 62			
N=	+17 9 30	36	23 17	3 24 21	26 19	26 20	25 26 27	26 23	10 26 32	26- 2A	26 30	26 55	26 60	11 26 57	15 26 63	16 26 71	34 26 76	25 26 80	36 25 83	31 23 87	-18 18 121	-49 6 LD6	-76 - 3 40		
N=		-90 130	-13 27 29	55 58 -0	28 23	78 31	15 28 33	19 28 45	26 28 42	33 28 44	38 28 43	26 34	36 27 66	27 80	26 27 70	34 27 60	41 27 77	24 15 63	21 25 67	20 25 77		155	140	1	
10 N=	-40 22 68	95 55	-26 28 14	-29 28 45	-23 28 53	-18 28 54	-27 28 70	-13 28 77	-19 26 87		-7 28 104			16 95 23			46 28 179				197	135		165	
11 N=	71	-57 30 132	47 93	47 102	108	106	116	111	106	108	116	111	119	-104 · 47 321	142	159.	194	209	198	39 184	232 785	1A 252	24.B	7 160	
12	-45	-69 -	- 134 -	-166	-209	-224	-234 53	- 254	-263	-257	-255	-208	-190	-176 -	-136 -	118	-82	-42	-48	-92 -	-154 -	- PSP -	374 -	129	

			MONTH	al v M	EAN MI	101R	ONAL 4	11 NO .	NUMBI												M. FOI	PPI	HROSE			
			PER [00 OF			/69 Tr	127	71		TUDE	55	LONG	TUDE			H/SEC	1145	5 TEN		AOKM					70KM
HON	TH/LEY	VEL			:	30KM				4	4 () K M					50KM										, nu
l N=	-67 27 18	-77 27 83	-90 27 99	-86 27 103	-93 27 103	-82 27 116	-62 27 134	-93 27 152	-83 27 187	-88 26 220	-89 26 233	-66 26 465	-83 24 266	269 25 -80	-59 21 276	-55 21 302	-52 21 326	-53 19 322	-75 18 287	32 16 178	5 11 134	37 4 139	245			
M= S	-45 25 51	-53 25 56	-56 25 63	-63 25 61	-66 25 69	-71 25 74	-88 25 93	-65 25 96	-60 25 108	-43 25 128	-23 25 150	-23 25 180	-42 25 234	-47 25 257	-38 25 275	-30 25 301	-39 25 294	24 261	32 24 282	73 19 209	135 13 195	139 7 250	281	171	403 256	3
3 N≖	-17 20 31	-12 20 44	-14 20 39	-26 20 40	-26 20 42	-3+ 20 52	20 57	20 67	-46 20 93	-57 21 101	21 111	-50 21 107	-50 20 151	135 50 -58	20 104	34 19 147	58 19 147	67 18 172	108 17 159	155 11 142	278 8 161	316 6 129	293 3 167	380	710 L	
4 H=	11 22 54	26 22 56	24 22 64	13 22 51	16 22 67	22 22 22	35 22 72	20 22 77	25 22 64	32 22 10	30 80	82	36 21 75	61 21 78	67 21 65	66 21 61	75 20 77	80 20 98	96 20 90	101 18 95	150 16 137	166 11 172	174 9 82 212	246 7 93 222	314 7 110 385	462 66 340
5 N=	-12 28 35	28 28	28 28	21 28 46	10 28 25	28 21	11 28 28	29 12	11 28 27	25 28 48	-2 28 47	11 28 42 32	12 28 46	28 46 33	27 28 44 68	31 27 62 52	26 61 58	26 85	24 97	24 124 93	16 60	151	105 137	152	175 360	ĭ
N=	-40 10 57	-11 10 39	10 14	10 20	2)	58 10	12 10 21	14 10 34 29	19 10 20 26	22 10 65	36 10 22	10 30	10 57 27	10	10	10 54	10 53	10 59	8 54 79	91	95 8	41 241	3 59	100	*22	
N.	1 13 43	13 27	. 13	13 16	13 - 24 - 16	30 13 15	13 24	13 32 2	13 29 16	13 31	13 30 23	13 30	12 43	10 79 25	10 67 17	60	90 90	7 67 105	61 103	62	138	190	69 215	108	210	620
N=	27 49	20 49	26 22	28 21	28 21	20 27	28 31	28 50 20	28 27 34	32	28 45	2A 67	28 67 68	27 95 53	27 64 56	27 62 56	26 104 62	26 89	100	24 92 88	119	20 177 91	205 213	133	155	2 250 530
N=	22 44 -14	22 54 -25	22 44 -21	22 37 -15	22 40 -37	22 24	-20 52 53	22 40 -61	22 37 -56	21 19 -14	21 45 -23	21 72 -17	71 65	62 21	20 45	19 66 63	16 92 34	131	16 80 72	16 118 101	106	10 49 145	7 209 164	5 102 205	73 73	160
11	15 56	15 41 -9	15 48 -27	16 46 -30	16 92 -46	16 51 -43	16 50 -58	16 53	16 54 -78	16 115 -74	16 95 -98	16 69 -86	17 70 -76	17 76 -19	17 86 -50	16 70 29	16 129 -7	16 151 7	14 220 87	14 158 41	213 54	230 +5	120	2 15 -29	95 30	230
12	14 59 -50	14 49 -78	41 46 501-	14 67 -38	14 72 -145	14 79 -166	14 75 -209	-218	103 206		130 130 -239	15 146 -211	154 154 -171	145 165 -149	14 168 -179	174 -150		285 - 188	158 158 -184	244 -91	1+3 -21	167	110 315	160	•	1
N=	8 75	79	136	271	134	144	170	176	177	188	201	152	140	134	174	264	280	291	519	273	428	352	445	120		
			MONT	HLY M	EAN H	ERIDI	ONAL	w [ND+	NUMB	ER OF	0856	RVAT	กมระ	AND S	TANDA	AD DE	TAIV	0NS+	20 TO	70 .	M+ FO	H YOL	GOGRA	ND.		
							ONAL /65 T				OASE			AND S			VIATT				(M• FO	H YOL	GOGR	<u>AD</u>		
MGM	ITH/LE	VEL													-45					O .	(M• FO GOKH	# <u>YOL</u>	GOGRA	<u>ND</u>		70КН
MGA 1 No	ITH∕LE 25 13 81	VEL 44 13 84				AD 1					TUDE				-45	•		TEHE				PR YOL	GOGRA	<u>ND</u>		70KH
MGN 1 No 2	25	44	PERI	00 OF 56 13	9EC0	30KM 55 13	/65 T	0 12/ 65 13	70 -11 13	-15	TUDE +0KM 11 13	49 104 12	190 12	12 88 11UDE	-45 -44 10	-13 10	16 5	3411 : 05 3	5 TEN	-519		PR YOL	GOGRA	<u>ND</u>		70KH
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1 N= 2 N=	25 13 87 -31 10 52 8 6 9	44 13 54 -18 10 48 -21 6 43 -19 14	PERI 41 13 115 -21 10 62 21 6 27 -27 14	56 13 114 	50 13 102 17 10 53 -18 60 -36 14 64	30KM 55 13 111 54 10 73 -12 6 35	/65 T	0 12/ 0 13/ 13/ 141 41 10 50 -11 6 39 -3 14	-11 13 151 33 10 40 -33 61 -20 13	-15 13 105 28 10 113 -20 6 96 12 13	111 133 149 47 100 137 -30 66 22 13 82	104 12 128 61 10 143 -35 61 132 64 13	190 12 274 58 10 207 -176 326 75 13 158	88 12 255 21 10 307 -203 6 307 18	-45 10 205 34 10 249 -99 6 247 17 13 176	58KM -13 10 246 -66 10 168 -27 6 235 43 12 166	16 5 91 -24 6 134 10 5 252 78 9	20 3 171 -32 3 133 193 3 184 72 6	5 TEN	-519		PR YOL	GOGRA	<u>ND</u>		70КМ
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						ERIDI AD 1								AND S			EVIATI (M/SEC				(M. FC	PT.	MUGU			
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МО: 1 М=	NTH/LF -19 49 34	Y€L -9 49 39			RECO	AD 1				LATI	TUDE				119	1						P PT.	MUGU 130 2 50	90 2 30	60 L	70KM 170 1
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